ASSESSMENT OF WOOD RAW MATERIALS IN COLORADO'S FRONT RANGE

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FINAL REPORT

ASSESSMENT OF WOOD RAW MATERIALS IN COLORADO'S FRONT RANGE

Submitted to

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United States Forest Service

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ASSESSMENT OF WOOD RAW MATERIALS IN COLORADO'S FRONT RANGE

The Problem

The mountain pine beetle epidemic in the Front Range of Colorado has been identified by both Region 2 of the U.S. Forest Service and the Colorado State Forest Service as one of the most urgent forest management problems in the area. Ways must be found to utilize timber that needs to be removed to put stands in a healthier growing condition. As a first step in developing these needed outlets, an assessment must be made of the wood raw materials potentially available in the Front Range Region. Currently the lack of such information is an impediment to generating suitable industrial capacity and to developing suitable courses of resource management for long term beetle control. This study develops an extensive assessment of such information in the Front Range area of Colorado.

Problem Reference

This problem has been identified and selected for research in Rocky Mountain Station Research Work Unit Description FS-RM-4251.

Introduction

The mountain pine beetle is currently in outbreak status in Front Range ponderosa pine stands. A USDA Forest Service report "The Western Insects Issues Study" Region 2 Report, 1976, estimates that an annual mortality of 27.3 million cubic feet is caused by the mountain pine beetle. This report makes a more accurate estimate of beetle-caused mortality. These losses are expected to continue at present levels or possibly increase if nothing is done. An effective control program to reduce these losses must include salvaging the infested trees along with improving the condition of the "susceptible" forest. A recent Forest Service Technical Report, RM-7, states that most beetle infestations are in overcrowded stands. To improve the vigor and resistance of these stands, a large scale thinning program would have to be initiated along with other direct control measures. Further, the control program, to be successful, must consider not only the utilization problem related to beetle kill, but must also include long term utilization needs and consider all of the timber within the timbershed.

As part of the overall beetle problem analysis, this study will assess definitively the total wood raw materials potentially available in the Front

Range area of Colorado. These raw materials include timber and timber by-products that would be made available through a timber management program sufficiently intensive to bring the present mountain pine beetle epidemic under long term control.

This study is part of a series of three studies. The other two studies are: Production and Marketing Strategies for Utilizing Beetle-Killed and Associated Front Range Timber, CSU Project 31-1470-1412, RM Contract No. 16-664-CA and Suitability of Beetle-Killed Pine in Colorado's Front Range for Wood and Fiber Products, CSU Project No. 31-1470-2191, RM Research Agreement No. 16-644-CA.

Study Objectives

To estimate from the best available data the volumes, values and costs associated with merchantable and nonmerchantable roundwood and forest and mill residues potentially available at various alternative processing locations in the Front Range.

Approach

The basic approach to this study involves collecting and organizing available data concerning volumes, values and costs of wood raw materials at selected processing points. Most of this information was acquired from the USDA Forest Service Region 2 office, the Colorado State Forest Service, local industry, and individual National Forests in the Front Range area. Also, information was gathered from published literature. As the data were being compiled, the accuracy of estimates was tested by consulting knowledgeable individuals in the area of concern.

Estimates of annual mortality caused in the Front Range by the mountain pine beetle were developed in this study. Although these estimates differ from earlier reports, we believe that they are the best estimates currently available.

In developing the estimates, we attempted to use all available information. Because we are studying utilization of beetle-killed pine, we restricted our estimates to areas considered accessible for timber harvest. As explained later, this included the standard and special components of U.S. Forest Service lands as well as accessible noncommercial U.S. Forest Service lands; and, in addition, all other forest lands. Annual mortality in terms of number of stems was based on ocular stem counts taken aerially by the U.S. Forest Service and stem counts or estimates from the Colorado State Forest Service. Average diameters and

heights of beetle-infested trees were supplied by the U.S. Forest Service. Due to the lack of detailed information on diameter distributions of beetle-infested trees, volumes were estimated by simply multiplying the volume of a tree of average diameter and height (for beetle-infested trees in each portion of the Front Range) by the estimated number of stems killed.

There are certainly several possibilities of bias introduced in the estimates. Ocular tree counts supplied to us may include some unknown bias. Because it was impossible to distinguish between commercial and noncommercial lands during the flights, we cannot split the estimates for accessible U.S. Forest Service lands into these two categories. Next, a tree of average diameter and height is usually not a tree of average volume. However, due to a lack of detailed information, we treated them as such with the assumption that the bias introduced was small enough to be acceptable.

Other possibilities for bias during the estimation process exist. However, we feel that these are relatively small and the resulting estimates are reliable enough to substantiate the conclusions of this report. They are certainly the best estimates currently available until a detailed survey can be justified.

There was no collection of primary data. Thus, in some cases, estimates were made using somewhat limited data. When this did occur, the procedure used to develop the estimate is carefully documented by the investigators.

The data are classified and presented in such form as to provide technical and economic meaning with respect to harvesting, processing and marketing of timber and timber products along the Front Range.

Methodology

Area of Concern

This report identifies the Front Range area of primary concern with respect to the ponderosa pine beetle infestation. This area of concern is composed of infested and threatened forests, regardless of ownership, accessibility or economic operability of the timber. All lands between isolated infestations are included as part of the area of concern. The size of the infestation is not a criterion for determining whether or not it should be part of thea area -- any size infestation is included.

Processing Center Selection

Six processing centers, located along Colorado's Front Range, were chosen as case studies for this report. The criteria for selection included, 1) exist-

ence and current capacities of the local timber industry, 2) presence of transportation networks suitable for use by forest products industries, 3) proximity to infestations, and 4) the area's topographic features.

At this point it is best to define some of the terminology used in this report. A processing area is an area where the products are being or potentially can be manufactured. For instance, the cities of Fort Collins and Loveland are a processing area. A tributary area is the geographic area from which a processing center can potentially draw its raw material. Following the above example through, the Fort Collins-Loveland processing area can draw from part of Albany County, Larimer County, Boulder County, Clear Creek County, Gilpin County and part of Jefferson County. Thus, these counties make up the Fort Collins-Loveland tributary area. A processing site is basically the equivalent of a processing area except that a processing site involves only one city. Denver is an example of a processing site. A processing center is an inclusive term which can be either a processing area or a processing site. Both Denver and Fort Collins-Loveland, therefore, are processing centers.

For each processing center the data assembled include:

a) the area population and major population centers,
b) location and characteristics of the tributary area transportation system, and
c) the center's existing wood utilization capacity.

These data concerning population and major economic activities were collected from the Bureau of Census and/or Department of Commerce publications.

The transportation system in and around each tributary area has been identified. All major rail systems and road networks are defined including federal, state, county and main forest roads. Current average figures concerning freight rates were collected for truck and rail transportation modes, as pertinent to each location.

In identifying utilization capacity, the firms included are in, or around the processing center. The existing utilization capacity of these forest products firms was sometimes based on the Colorado Forest Industry Directory. If the utilization capacity was not known, industry or the Colorado State Forest Service, U.S. Forest Service districts, or the State and Private Forestry division of Region 2 were consulted.

Tributary Area Boundary Determination

After each processing center was selected, it was necessary to determine the area considered tributary to the particular site. The resource situation within this tributary area is the main consideration of this study.

The area tributary to a particular site was determined on the basis of reasonable expectations about the resources that could be made available to the processing center on an annual basis in the "foreseeable future." In an area where national forest land was the primary source of timber tributary to a particular site, the forest's current Timber Management Plan (TMP) was used to define "foreseeable future."

Usually these TMPs span a ten-year period. If timber management plans for other ownerships were available, they were used. For areas where no management plans existed, a "foreseeable future" of ten years was assumed arbitrarily.

In the case of the Pike and San Isabel National Forests, the time frame for the TMPs was from 1963 to 1973. No other updated information was available at the time of this writing. In the absence of better data, these plans were utilized.

Each processing center will have a unique wood procurement area since topographical features and transportation systems will vary by sites. Depending on the location of the processing center, this supply territory may be made up entirely of timber lands within the area of beetle infestation or include only a portion of the infestation zone; the rest of the site's supply territory would be comprised of timberlands outside the outbreak area. Boundaries for processing centers may overlap; however, each center is analyzed as a separate case study.

The tributary area boundaries were established based on consultation with U.S. Forest Service personnel, Bureau of Land Management, local industry and Colorado State Forest Service contacts. Of course, a number of factors influence the distance a firm will travel for timber. The size of the sale, quality of timber, volumes per acre, current market conditions, type of wood product manufactured and firm size all must be considered. In this study, to simplify the establishment of boundaries, the criteria used are average market price and local conditions, past procurement activities, and what is likely to be available in the "foreseeable future." The boundaries, therefore, are not to be considered as absolutes but as averages and what is "most likely" to be

the case. Every effort has been made to utilize existing inventory data and classification avoiding unnecessary extrapolation or adjustment error, and still provide economically sound boundary determinations.

Raw Material Taxonomy

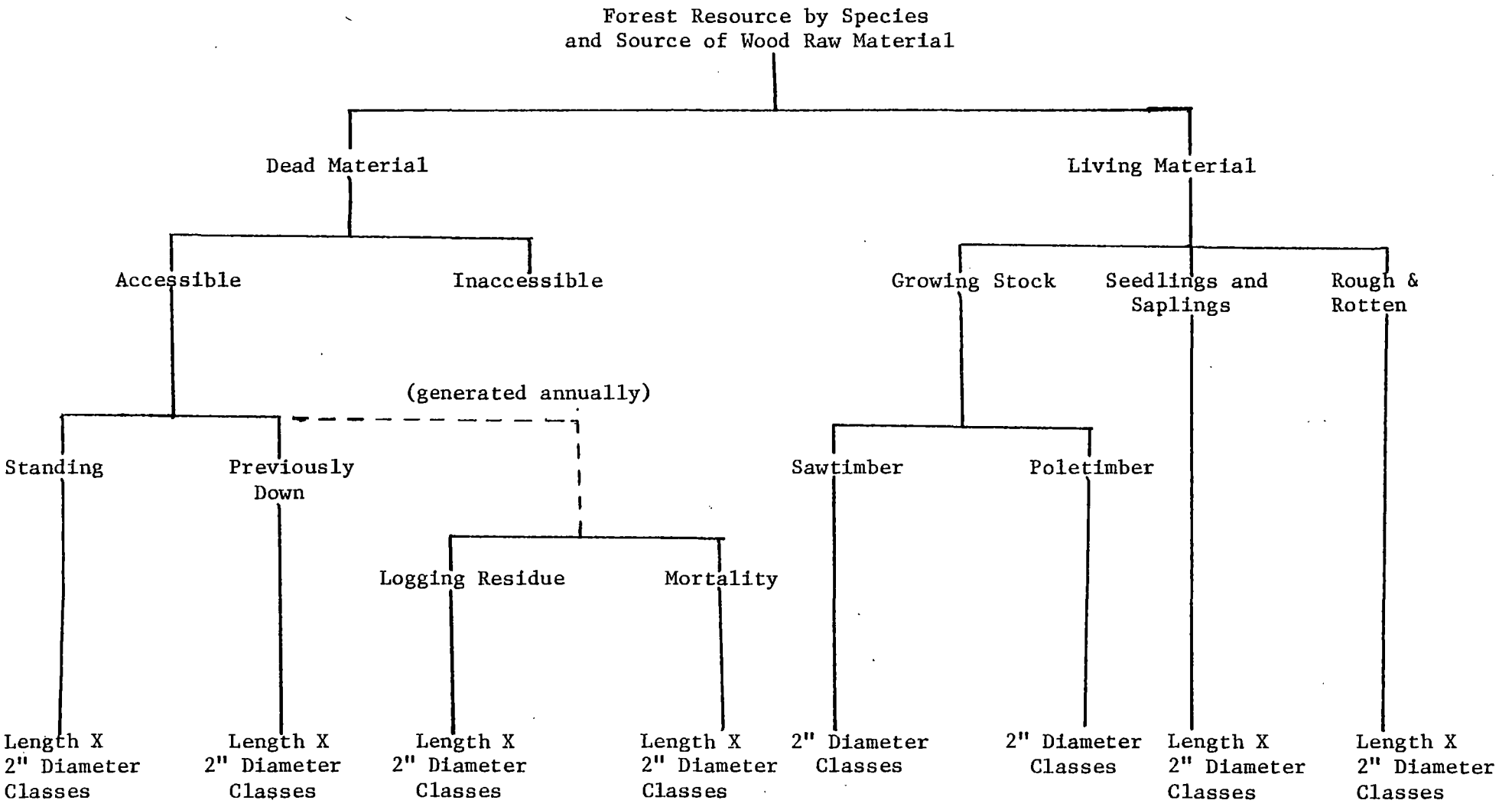
The volumetric and qualitative estimates for each processing center were compiled using basically the same raw material taxonomy developed in the previous CSU study, Availability of Wood Raw Materials at Selected Rocky Mountain Locations.

A classification scheme for wood raw materials (Figures 1 and 2) was developed that could be used to represent the resource situation within any particular area. Due to the wide variety of forms in which wood fiber may exist, it can be described in different ways, such as sawtimber versus poletimber, live versus dead timber, or rotted versus sound timber. Furthermore, because of the various ways that wood is utilized, there exists corresponding differences as to the type of material that best fits a particular type of use. The taxonomy that was developed, therefore, reflects not only the forms in which these materials are found or generated, but also the forms in which they can be utilized.

The taxonomy was developed using three criteria. First, to take advantage of available data sources, it was stipulated that the system should use existing terminology as much as possible in describing the various types of wood resources. Existing definitions were, therefore, used for most categories. One exception to the existing terminology was the "dead-down" category. Up to this time, definitions of salvable dead material have included only those dead trees that were standing at the time of the inventory. Because the dead-down category represents considerable volume in some forest types, it was included in the new taxonomical scheme.

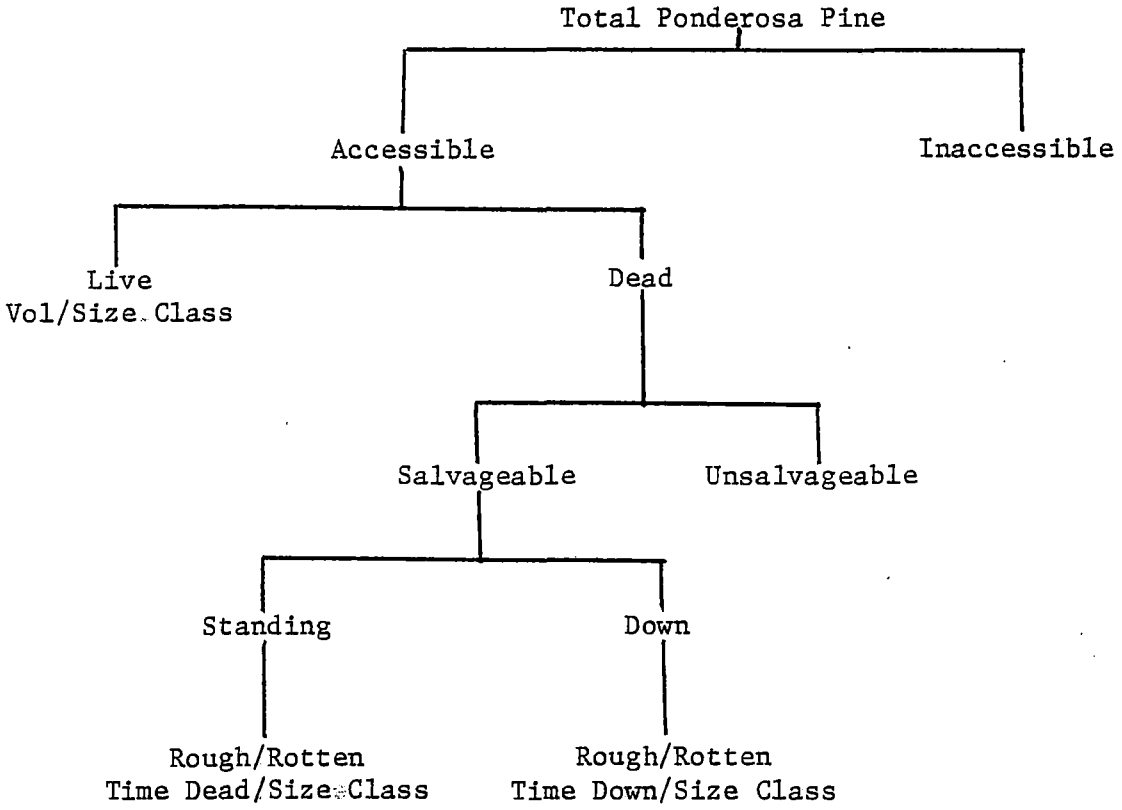
Second, the taxonomy developed also had to reflect adequately the resource as it existed at a particular point in time. Each category in the taxonomy, therefore, had to be mutually exclusive, not only as to source but as to time. Also each successively higher category must aggregate those categories below it. Since logging residues and future mortality volumes are indistinguishable from other downed resources, they are treated as additive amounts that can be applied to existing inventories on a quantity-per-time-period basis.

Figure 1. Taxonomical scheme for wood resources available from the forest.



Source: Availability of Wood Raw Materials at Selected Rocky Mountain Locations.

Figure 2. Taxonomy of Wood Resources for Ponderosa Pine.



Finally, a classification scheme must entail a logical flow from qualitative data, such as source, to quantitative information such as size, With the exception of growing stock, this type of information is not available for the current taxonomy. However, in the future more sophisticated inventory techniques, coupled with computerized information systems, may make recovery of such detailed information possible. If size were included with each source of raw material, then a prediction of the product potential could be made for the volume figures. For example, the volume of dead material 16 feet long and 20 inches in diameter has a different product potential than the volume of sawlogs of the same size cut from the live timber, or the volume of other dead material of a somewhat smaller size.

A glossary defining terms used in this taxonomy, as well as other terms used throughout this report, is included at the end of the report.

Estimating the Resource Volume Tributary to Each Processing Center

Information Sources -- After development of the resource classification scheme, the next step was to determine the volume of each resource type, by species, tributary to each processing center. There was no primary collection of data. When available, basic quantitative data for the timber resource were derived from inventory listings supplied by the Forest Survey Unit, Intermountain Forest and Range Experiment Station, Ogden, Utah. Additional information came from the U.S. Forest Service Regional Office and Colorado State Forest Service. Information for each processing center was also solicited from companies and individuals involved in the timber enterprise.

Inventory Data Analysis -- The basic approach was to record the timber volume on land within the tributary area by summing up the inventories of the various land segments therein. The tributary area was divided into such segments as counties, national forests, state and private ownerships.

In areas where the tributary boundary did not coincide with the boundary of the area for which a volume figure was available, a volume proportional to the included land area was calculated. This adjustment is referred to as an area adjustment factor throughout this report. When data covered a land area completely encompassed by the tributary boundary, the area's total volume information was used. These volume and land area data tributary to each site were then summed so that the total resource available in the area could be determined.

In general, the approach in estimating resource volumes involved obtaining the most current information from each of the cognizant land owners or managers. In the case of national forest land there were several ways in which this was achieved. Every national forest has a Timber Management Plan (TMP) that spells out the amount of timber that will be made available over a stated time period. TMPs usually contained timber volume information in a form that could be utilized in this study. At the time this study was conducted, the Pike and San Isabel National Forest current timber inventory has not been completed. Because of this, some of the area and timber volumes presented in this report are tentative and may be revised. However, it is reasonable to assume that the values obtained are relatively close.

Information was also obtained for National Forest land by using the timber inventory computer printouts and the Resources Planning Act (RPA) printouts. These sources allowed for a more detailed breakdown of figures than is permitted by using only the TMPs. In the case of the timber inventory printouts, acres and forest type volumes were broken down into considerable detail. The RPA printouts gave detailed information by county and forest species. By utilizing both of these sources for the Arapaho-Roosevelt National Forest, a better evaluation can be made of the operability of the tributary area.

Information was obtained from the Rocky Mountain Forest and Range Experiment Station in determining volumes per acre of non-commercial forest land (non-CFL). These figures were derived by utilizing a sample of 24 plots of non-CFL land in Manitou Experimental Forest. From these plots an average volume per acre was developed and multiplied times the number of acres of non-CFL land in a given tributary area to obtain a total volume figure. An accessibility factor is usually applied to volume figures. However, in the case of non-commercial lands, no information could be obtained as to what percentage of these lands are accessible; therefore, the accessibility factor was considered to be one. The accessibility factor is defined in the glossary section of this report. Accessibility factors are applied to all other volumes and acreages in this report. In all cases of state and private lands the accessibility factor is 1. In other words, the state and private lands are assumed to be 100% accessible. Accessibility is reflected in the Colorado State Forest Service Timber Resource Inventories (TRIs) which were employed in this study.

In the case of the BLM lands the data are presented for the entire Front Range of Colorado. This is because the information for BLM lands could not be determined by small areas. Therefore, the BLM data is presented at the beginning of the case studies for the various processing centers in this report and is not broken down by county or tributary area.

Information concerning state and private land tributary to the various processing centers was obtained from the Colorado State Forest Service (CSFS) usually in the form of TRIs. These published reports contain area and volume data by stand-size class for each commercial forest type within a county. Some information concerning non-commercial forest land was obtained by utilizing Timber Inventory information provided by the State office in Fort Collins. The CSFS also supplied stem count information used in determining beetle kill mortality in the counties south of Park County and for Boulder County.

Mortality and Dead Material

The mortality and dead volumes were derived by using several different approaches. Because of their uniqueness when compared to other types of volume information, special consideration had to be given to mortality volumes, as well as dead material volumes. As in all timber volumes throughout this report, care was taken to include only that material on land that is considered available for harvesting. In the case of the U.S. Forest Service lands, this included only the standard and special components of the commercial forest land (CFL). Otherwise, the mortality and dead volumes were reported in total CFL within the tributary area.

Data were obtained from the RPA printouts, Timber Inventory computer printouts and the Timber Management Plans for the Arapaho-Roosevelt National Forest. The figures for the Pike-San Isabel National Forest were obtained from the TMPs developed for the individual Pike and San Isabel National Forests.

The state and private lands figures used were developed in the previous CSU study, Availability of Wood Raw Materials at Selected Rocky Mountain Locations, CSU Project 2082, RM Contract 16-431-CA. Also employed were the volume/acre factors used in the previous CSU study which were obtained from the Intermountain Forest and Range Experiment Station, Forest Survey Unit. These factors assume 831 cubic feet (cf) of 5 year mortality (standing) for spruce per CFL acre of spruce timber and 825 cf of sound dead (down) for lodgepole pine per CFL acre of lodgepole pine.

The logging residue that would be generated by whatever cutting strategy chosen could be estimated by multiplying .1043 times the cubic foot volume harvested annually in Colorado. This 10.43 percentage figure was developed from Setzer's Logging Residues on Harvesting Operations, Western South Dakota, Wyoming, Utah and Colorado, INT-135 publication. The Intermountain Station also estimates that in Wyoming 7.68 percent of the harvest cubic foot volume is left as residue.

The volumes for ponderosa pine mortality were calculated using ocular stem counts that were taken aerially by the U.S. Forest Service and stem counts or estimates from the Colorado State Forest Service. Percentages of the mountain pine beetle (MPB) infested timber were estimated for each land ownership class (National Forest land and private land). The percentage figure used was derived by the Colorado State Forest Service. The number of stems were multiplied by an average cubic foot volume per stem. The average diameter breast height (dbh) plus heights for beetle infested trees were acquired from Insect and Disease Group of the USFS Region 2 office. The average cubic foot volume is taken from the Southwestern Ponderosa Pine Volume Table, RM-2, by Clifford A. Myers. The R-2 Insect and Disease Section supplied the average dbh for the trees being lost to the MPB for different areas along the Front Range. The average height of the trees is fifty-five feet. The cubic foot volumes were multiplied by the number of stems for each county to give total volume for each county.

The accessibility factor was applied to the national forest land portion of the MPB infestation. For state and private lands, the mortality reported was that on the total CFL within the tributary area. A build-up ratio obtained from the Insect and Disease Section of the R.O. is applied to the 1976 mortality to predict next year's mortality. A build-up ratio fs a factor which predicts the number of trees to be killed next year to the number of trees already killed. No figures could be obtained for mortality remaining from past years because the number and amount of firewood and salvage sales could not be accurately determined.

Estimates of Expected Cut -- On U.S. Forest Service lands, the volumes to be cut are reflected in the programmed allowable cut and the potential yield of the particular National Forest in question. By definition the programmed allowable cut is that volume scheduled to be cut from the land, while the potential yield is a measure of that harvest over the next ten years needed to achieve the optimum sustained yield from the area. These volumes did not, in

most cases, reflect exactly what was being removed from the particular land area but were rather an approximation of what could be removed and what was planned. When yields could be obtained from amendments to the TMPs, they were used in determining harvests.

The amount of ponderosa pine to be thinned was examined more closely so that ponderosa pine volumes harvested through implementation of the silvicultural control program could be predicted. The following procedure is used in predicting these volumes: the average amount of wood to be removed in thinning one acre of ponderosa pine along the Front Range is 300 cubic feet per acre. This estimate was the average of estimates obtained from a number of professional foresters from USFS and CSFS districts and state office. The 300 cubic feet per acre was multiplied by the number of acres of ponderosa pine for state and private lands. In the case of national forest lands the appropriate accessibility factor was applied so to include only accessible volumes that would be generated from a thinning program. The thinning program recommended by the R.O. will involve thinning 25% of the poletimber stands. All of the ponderosa sawtimber is assumed to need thinning. None of the seedling-saplings are assumed to be scheduled for thinning. TMPs contain potential yield for sawtimber volumes only. This should be kept in mind when comparing the above thinning volumes to potential yield on USFS lands.

Once the volume per accessible forest area is computed, the figure is divided by 5 years to give the volume per year which could be removed. The 5-year interval in which to perform the thinnings was chosen by the Region 2 office.

No estimates were made for ponderosa pine thinnings for the BLM lands because of inadequate data.

Definition of Terms -- Due to the numerous sources queried for volume information, problems concerning the definition of various forestry-related terms did arise. For example, the U.S. Forest Service definition of commercial forest land includes standard, special, marginal and unregulated components. Only the first components, standard and special, represent timberland which is considered currently available for harvest. The latter terms describe areas which for reasons of topography, timber volume, etc., cannot be harvested with existing systems for reasons of cost of possible environmental damage. Since this study is concerned with the availability of timber resources within the foreseeable future, only the standard and special land components were considered.

Complications also arose concerning growing stock. The delineation between poletimber and sawtimber size classes ranged anywhere from 9 to 11.5 inches. This discrepancy was allowed to exist in our reporting, since in most cases, only the general stand-size class designation was given, without any segregation by diameters. Also CFL land is defined differently by the Colorado State Forest Service (CSFS) than by the USFS. However, data acquired from the CSFS was compared to federal data with no adjustments made. Many other assumptions had to be made in the compilation of forest resource volume information. The specific assumptions applicable to a processing center are described in the case study developed for that particular processing center.

Processing Information

The CSFS Forest Products Directory was consulted and local wood processors and timber management officers were queried to find the locations of wood processors along the Front Range. The local individuals had the best information concerning those businesses in operation. The individual processors were then questioned to find the volume of products and residues which are currently being produced. This information is correlated with the processing center selection portion of the methodology used in this report. The current capacities for each tributary area are given in table form listing products and mcf volumes for each product that can currently be produced. As the data were compiled the accuracy was tested by consulting knowledgeable individuals. For example, small mill owners may at times tend to over-estimate mill capacities. Therefore, information of this sort was checked by consulting with the State or USFS District Forester.

Economic Considerations for Each Processing Center

Two sources of information were used to develop the necessary economic data. Specifically, these sources were the mills in a given processing center and timber management offices at both the forest supervisor's and district levels. The economic data consists of estimates of the lowest, highest and average cost of delivering raw materials of each class for a given processing center. The costs include stumpage, harvesting, hauling, profit and risk for each class of raw material based on the most common conditions for the processing point.

Logging costs were developed utilizing current Region 2 appraisals (1976 and back to January 1, 1975) for timber sales that sold. Also costs from local operators were used when available and their reliability was confirmed by know-

ledgeable individuals. A low, average and high figure was developed based on this information. Transportation costs were based primarily on distance of hauling logs to the processing center. Low, average and high figures were constructed considering the area characteristics. The low, average and high figures for stumpage, transportation and harvesting were combined forming the possible range of total procurement costs.

Due to the differences in transportation characteristics, a procedure was developed so that the processing centers could be compared. The number of miles for each road class were measured using county and forest maps. The miles of each road class are divided into forested and unforested areas. A forested area can include plains and unforested areas in high elevations. These areas were included because of the difficulty in pinpointing these parks and determining their acreages. Unforested areas consist of the plains acreage within a county.

The number of miles for each road class is listed by county for the entire area of concern in the summary section of this report. In each case study there is a subjective rating of how that particular transportation network compares with other tributary areas in the area of concern. These judgements are based on the overall effectiveness of transportation network in delivering the wood raw materials to the processing center.

The value of several products that could be made from each class of material is also estimated. The value of the products is based on current wholesale prices FOB the mill. The values are presented in both dollars per mbf and mcf so that the reader may compare these values to the inventory data which is presented in mcf. The conversion factors used to present the cost data in both mbf and mcf is presented in Table 1. This table also includes conversion factors for a product that is normally sold by the piece such as houselogs or a pallet.

To prevent disclosure of private sources of information, cost/value figures for all producers were combined into a given processing center. At the end of each case study a list of the mills which provided information and make up the existing utilization capacity is presented.

Table 1. Product Conversion Factors

Product Type and Size		Conversion Factors
Pallet	4'x4'	20 board feet (bf)/pallet
Timbers		81.47 cf /MBF
Fencing	3"x1"x6'	.16 cf /fence
Boards (rough)	1"x4"	81.47 cf /MBF
Boards (planed)	1"x4"	54.69 cf /MBF
Houselogs	8"x16'	5.58 cf /houselog
Barn poles	6"x20'	3.92 cf /pole
Corral poles	3"x16'	.78 cf /pole
Fence posts	3.5"x6.5'	.43 cf /post
Paneling	1"x4"	54.69 cf /MBF
Dimension lumber	3"x6"	81.47 cf /MBF
Studs	2"x4"	54.69 cf ?MBF
Firewood	4'x4'x8'	85 cf /cord
Decorative R.R. ties (treated)	4"x6"x6'	1 cf /tie
Chips	--	43 cf /MBF
Sawdust	--	21 cf /MBF
Shavings	--	16 cf /MBF

Source: Conversion Factors for the Forest Products Industry in Western Canada

Other Considerations

In order to develop, compile and record the multi-source data that are presented for each case study, several special items were considered. First of all, some categories included in the resource classification scheme have not previously been inventoried. This fact left many gaps in the volume tables presented in the case studies. Where this occurred, the symbol "N/A" is used to signify non-available data. This is to distinguish the unavailability of volume figures from zero volumes, which are presented as zeros.

Data were often collected in different units of measurement. Some entries had to be converted for the sake of consistency. An example of this would be the board foot to cubic foot conversions. Because of sizes of material dealt

with in this study, a conversion of 5 board feet per cubic foot of roundwood was used for both sawtimber and poletimber. This is the same conversion factor as used in the previous CSU report, Availability of Wood Raw Materials at Selected Rocky Mountain Locations.

Most of the data presented are in thousands of units. When converting these data to thousands, rounding was done to the nearest whole number. An exception of not reporting data in thousands is the number of stems of ponderosa pine beetle kill mortality. These data are presented as actual number of stems.

Case Studies

The analysis for each tributary area is covered in a series of case studies which make up the remaining sections of this report. The tables at the end of each case study list the sources of information that were consulted to complete that study. Only those sources that offered the best information were used. The basis for a decision to use a particular source of information is explained in each case study.

Summary For
The Entire Area Of Concern

This section will give an overview of the area of concern and present information that would not be appropriately presented in the case studies.

A map of the areas of mountain pine beetle infestations in ponderosa pine is shown in Figure 3. The solid black line indicates the area of general infestation. General infestation includes all infested trees regardless of how many are being attacked by the mountain pine beetle. This solid black line represents the majority of the ponderosa pine forest type along the front range of Colorado. The diagonal lines indicate areas where the infestations are particularly intense. The circle made with solid black lines show areas which are not infested and are not a potentially threatened area because they are currently non-forested.

This study assesses the total wood raw materials potentially available in the Front Range of Colorado. These raw materials include timber and timber by-products that would be made available through a timber management program sufficiently intensive to bring the mountain pine beetle epidemic under long term control. In order to accomplish this, six processing centers were selected and data for each are presented and discussed in the form of case studies. They are:

1. Fort Collins-Loveland
2. Boulder-Longmont
3. Denver
4. Pine-Bailey
5. Colorado Springs
6. Canon City-Florence

The criteria by which these centers were selected are included with each case study. All centers were selected based on the factors outlined in Perry R. Hagenstein's NE-16 research paper, The Location Decision for Wood Using Industries in Northern Appalachians.

In order that the beetle-kill mortality for ponderosa pine may be compared with other reports the mortality losses are reported in Table 1 on a

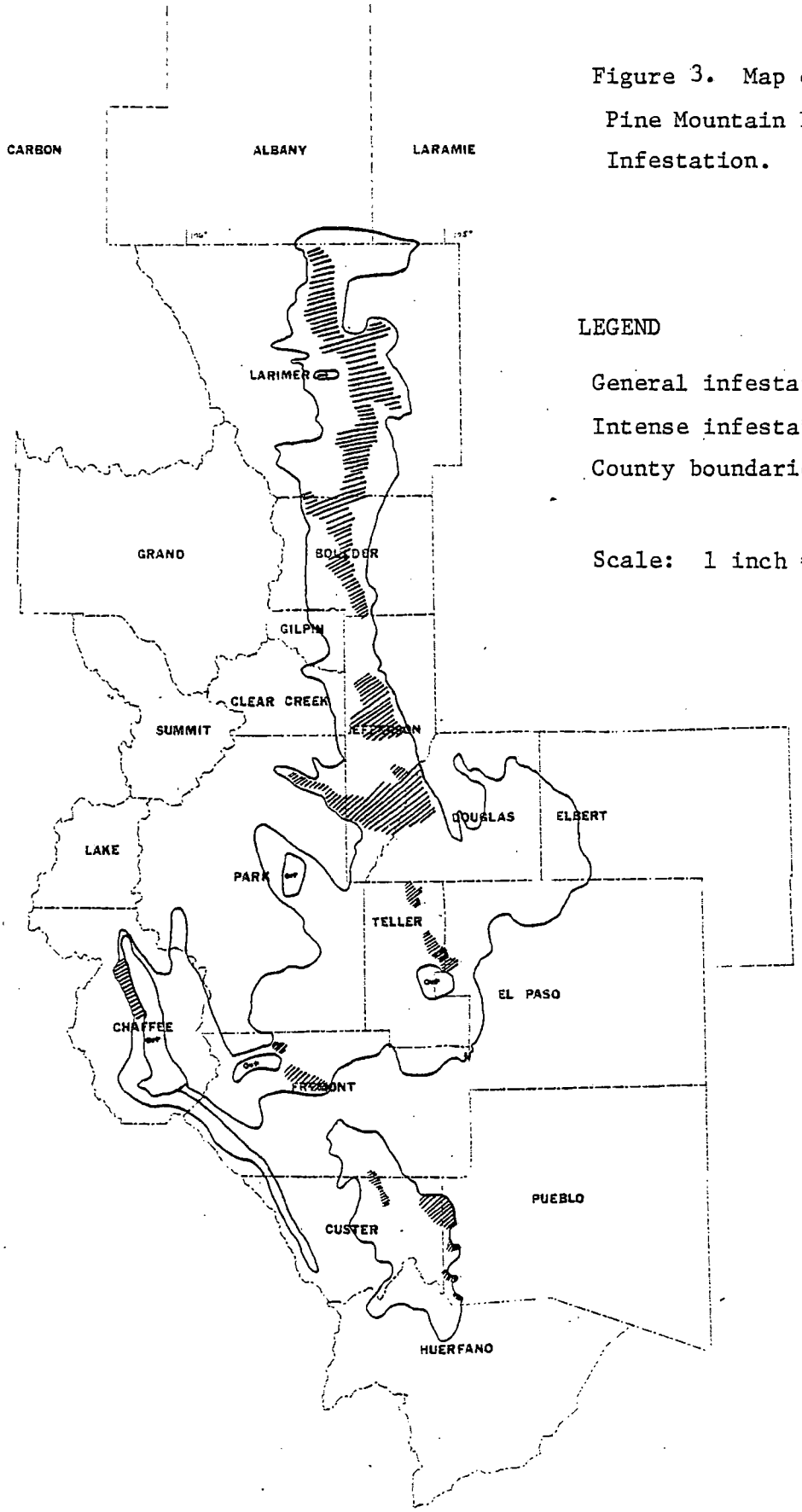


Figure 3. Map of Ponderosa Pine Mountain Pine Beetle Infestation.

LEGEND

General infestation ———

Intense infestation ////

County boundaries - - - - -

Scale: 1 inch = 34 miles

Table 2.

Volumes and number of stems lost to the mountain pine beetle on accessible commercial and non-commercial forest land in 1976 by county. (Includes all ownerships, federal, state and private.)

County Name	Number of Stems	Volume of Wood (MCF)
Larimer	149,000	1565
Boulder	194,000	2037
Gilpin	2,000	21
Clear Creek	8,000	84
Jefferson	100,000	1050
Park	9,000	116
Teller	3,000	39
Douglas	10,000	129
Elbert	3,000	39
Chaffee	4,000	52
Fremont	4,000	52
Custer	10,000	129
Pueblo	1,000	13
El Paso	20,000	258
Total	517,000	5584

Source: Compilation of information from individual case studies.

county basis, including federal, state and private lands for 1976. The 1977 losses are expected to be about 10% higher. Since the tributary areas for each case study overlap, Table 2 enables the reader to interpret the losses for the entire area of concern.

The volumetric data from the BLM were not available to be applied to the case studies and in the taxonomy of this report. However, some site specific data were received and are to be presented in this section for the Canon City district. This includes the acreage north of the Huerfano County Line and east of the Continental Divide, excluding the San Luis Valley. This area has approximately 80,000 acres of forested land. Of this land, 48,000 acres are commercial forest land containing 192 million board feet or 38,400 mcf. Fifty percent of the 80,000 forested acres is accessible. About 75% of the existing volumes should come from thinnings hence the size class would be mostly poles or small sawtimber. The remainder of the volume would come from stands of mature or overmature timber. The annual allowable cut for this area would be 1 to 1.5 million board feet or 200 to 300 mcf. This is a very small portion of the cuts that are tabulated in this report and will not have a significant impact on the case studies as presented.

Practically all of the trees on BLM lands in this area are alive except in Boulder County where the beetle kill mortality is very high. The BLM forested areas have the following composition:

Species:	
Ponderosa pine	43%
Douglas-fir	22%
Spruce	15%
Alpine fir	10%
Lodgepole pine	10%
	100%

The miles of each road class for each county throughout the area of concern are tabulated in Table 2. This information should be of reference value when the transportation characteristics of a particular tributary area are discussed in each case study.

The principal findings of the research are presented in the series of case studies, one for each processing center. A summary table, Table 3 contains the principal results of the resource inventory available to each of these centers.

More detailed inventory information broken down by ownership categories and production information by type of product capacities, costs and values of products at the processing centers, as well as by-product information is presented within each individual case study of this report.

Table 3. Miles of Each Type of Road Class By County.

County	Multi-lane Divided Hwy	Railroad	Multi-lane Undivided Hwy	High Type Paved Road	Bituminus Surfaced Road, Low Type	Gravel Surface Road	Graded & Drained Road
lbany (forested)		52		64		62	
arimer (forested)				182	3	276	35
arimer (unforested)	55	97		369	2	311	
oulder (forested)		8		115		127	1.5
oulder (unforested)	73	28		275		96	
rand (forested)		48		100		316	172
lear Creek (forested)		31		89	1	39	6
ilpin (forested)		16		36		33	19
efferson (forested)	9	7		105		114	
ouglas (forested)	27	51		105		154	3
lbert (forested)				26	1.5	82	3
ark (forested)				179		576	212
ummit (forested)		13		93		34	21
ake (forested)		42		89		36	5
haffee (forested)		64		113		67	
eller (forested)				60	1	39	6
remont (forested)		66		226		197	9
l Paso (forested)	44	32		59		57	2
ueblo (forested)				15		20	
uster (forested)				120	3	151	34
uerfano (forested)						23	

Source: County road maps and USFS visitors' maps

TABLE 4. AREA AND VOLUME SUMMARY TABLE FOR PROCESSING CENTERS EXAMINED

	Ft. Collins-Loveland		Boulder-Longmont		Denver		Pine-Bailey		Colorado Springs		Canon City-Florence	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Living Material												
Total Sawtimber	292,367	466,547	220,036	384,341	581,701	948,548	145,869	171,631	406,721	626,915	455,371	605,947
Total Poletimber	321,211	412,466	293,296	368,535	493,492	641,977	96,777	106,167	309,734	364,773	417,604	516,798
Total Seedling & Saplings	50,129	24,129	41,359	21,579	74,172	44,152	7,529	582	28,163	14,966	41,219	8,241
Total Rough Material	N/A	4,478	N/A	2,878	N/A	4,650	N/A	N/A	N/A	N/A	N/A	N/A
Total Rotten Material	N/A	11,176	N/A	10,276	N/A	11,498	N/A	N/A	N/A	N/A	N/A	N/A
Dead Material												
Total 5 year Mortality		41,266		36,760		102,268		33,872		123,978		174,430
Total Sound Dead		131,186		117,400		220,925		23,365		91,718		8,111
Total Dead	N/A	172,563	N/A	154,160	N/A	323,193	N/A	57,237	N/A	215,696	N/A	255,541
Annual (1976) Beetle Kill Mortality	N/A	4,736	N/A	4,736	N/A	4,840	N/A	1,476	N/A	2,448	N/A	638
Total Non-CFL	486,059	299,412	473,787	291,852	558,063	344,339	73,915	45,529	277,812	171,133	363,795	224,099
Total Annual Potential Cut	39,841	26,506	28,077	12,593	54,346	38,235	291	1,848	9,682	7,624	N/A	8,506
Total Annual Current Cut	4,732	5,725	3,781	4,649	6,153	6,513	N/A	333	704	1,616	N/A	1,493
Total Vol/year from Ponderosa Pine Thinnings	89,245	5,355	89,245	5,355	148,397	8,903	75,340	4,604	192,919	11,575	168,393	10,393

Source: Complication of information from individual case studies

1 Some acres are included in more than one area; hence data cannot be totaled for all areas. The totals include raw material classifications where acreage or volumetric data were not available in summing values for a given processing center. Therefore, the totals presented in this table are less than actual on the ground resources.

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3. U.S.D.A. Forest Service, Regional Office, Denver, Colorado.
4. U.S.D.I. Bureau of Land Management, State Office, Denver, Colorado.
5. U.S.D.I. Bureau of Land Management, Canon City District Office, Canon City, Colorado.

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Individual private concerns who contributed processor's information are identified in the individual case study reports. The authors here express their appreciation for their cooperation. Individuals representing public agencies who likewise contributed to this study include: Ron Gosnell, Terry Besson, James Getter, Bill Wilcox, Bot Mathison, Ed Gryczan, Steve Vest, Guyed Lund, Don Mitchell, and many other foresters who serve on ranger districts of the U. S. and State Forest Services.

CASE STUDY I -- FORT COLLINS - LOVELAND TRIBUTARY AREA

Summary

The Fort Collins-Loveland processing center has 918,796 mcf of living raw material; 172,563 mcf of dead material of which 4,736 mcf is beetle killed material that was killed in 1976. All of the above material is accessible to harvest. The criteria used to determine what volumes were accessible was taken from the timber management plans (TMPs) for national forest (NF) lands. Accessible land was the percentage of total national forest land that was special and standard land and that fraction of marginal land that was expected to be reclassified in the next 5 years. This was computed from data in timber management plans of the national forests. This percentage was applied to the volume figures which were in the timber inventories or regional resource planning act reports (RPSs) for the Roosevelt and Arapaho National Forests. Volumetric information was taken from the timber inventories and the RPAs because these reports had the most current and accurate information. Volumetric information concerning the Arapaho, Medicine Bow and Routt NFs were derived from the TMPs. This information was acquired from the previous CSU study under Rocky Mountain Research Agreement No. 16-596-CA. The Arapaho and Roosevelt NFs information in that report has been revised. The volumetric information utilized from the Arapaho RPA was computed by prorating a percentage of accessible land area (availability adjustment factor) of total forest area to volumes in Arapaho RPA. Also a boundary area adjustment factor was used for RPA data. In utilizing the TMPs, the Medicine Bow and Routt NFs were prorated by boundary adjustment factors.

Acreage and volumes of state and private data have been best developed by the State of Colorado. The Timber Resource Inventories (TRIs) published by the Colorado State Forest Service (CSFS) were utilized in obtaining this information. Wyoming state and private data were obtained from the previous CSU report which in turn had taken information from the Intermountain Station Forest Survey sources and the Wyoming State Forester. Only Jefferson County figures had to be prorated into the boundary. The Wyoming county figures (Tables I-1 and 2) were taken from the much older Intermountain Station Inventory. All commercial and non-commercial forest land for state-owned lands are assumed to be accessible.

The past 5-year mortality figures were 41,266 mcf for Fort Collins-Loveland and the dead and down was 131,186 mcf for the area.

The standing dead figures for counties were projected using the RM-125 figures of 831 cu. ft./acre for standing and down dead spruce-fir. The previous CSU report suggests that it is doubtful that this figure applies in the Fort Collins-Loveland tributary area. The Roosevelt and Arapaho NFs utilized figures from the timber inventories and this is likely to be more accurate. Trees on national forests that have been dead less than 5 years (5-yr. mortality) have been classified in this report as standing dead. NF timber that is dead longer than 5 years (sound dead) is classified as dead and down material in this report.

The dead and down figures for counties were derived from a 825 cu. ft./acre figure of lodgepole pine down dead material in Wyoming (Int-181). The reliability of this figure as applied to Colorado may be questioned.

The beetle kill volumes of ponderosa pine total 4736 mcf for the Fort Collins tributary area. The volumes predicted for 1977 are arrived at by applying a 1:1 build-up ratio to the 1976 kill. This build-up ratio was acquired from the insect and disease section at the USFS Regional Office. The 1976 volumes are calculated using an adjustment factor for each county in which the R.O. office has an aerial ocular survey. This adjustment factor was used to separate the state and federal timber from the total stem count which the R. O. determined. The adjustment factor was derived through consultation with the CSFS. A sampling factor (blowup factor) of 2.5 was applied to the R.O.s stem count to determine the number of beetle killed trees on the ground.

The Fort Collins-Loveland tributary area non-commercial forest land volume is 299,412 mcf. The total potential yield is 26,506 mcf per year. The current cut is variable, but averages 5,724 mcf. The potential volume of ponderosa pine that would be removed each year from a five-year thinning program reducing stands to a growing stock level of 80 square feet per acre is 5,355 mcf.

For the Fort Collins-Loveland processing center the total production capacity was 2,987.6 mcf per year for primary products and 1864.3 by-products annually. The stumpage costs averaged $11.58/mbf for sawtimber, $0.50/cord for poletimber and $0.50/cord for firewood. Harvesting costs which included profit and risk costs averaged $42.26/mbf for sawtimber and $19.19/cord for firewood. Altogether, the total delivered costs averaged $90.01/mbf for sawtimber and $39.40/cord for poletimber.

The transportation network for the Fort Collins-Loveland tributary area was given a transportation evaluation of average. The processing area has a population of 85,225 according to 1975 reports. Both rail and truck freight transportation facilities are available. This processing center is used as a base for comparison of transportation systems between centers.

Introduction

Since this is the first of the series of case studies, an indepth treatment of procedures will be presented here. Thus, this case study may be of particular value as a reference for the following cases regarding adjustment factors, volume per acre factors and examples of methodology.

This case study examines the total raw material available to the Fort Collins-Loveland processing area. It is doubtful that aggregating these two sites will seriously affect the utility of the data due to the close proximity of Fort Collins and Loveland. Either site would serve equally well as a location for a wood processing operation, although Fort Collins at the present time greatly exceeds Loveland in wood product manufacturing capacity. The two sites were combined because of their similar location characteristics which make them a potential processing center.

The Fort Collins-Loveland processing center was chosen as a case study primarily because Fort Collins presently has a large number of mills. Because of its comparatively high wood utilization capacity it is probably the most important processing center along the Colorado Front Range. Also this area is close to the northern portion of the beetle infestation and this area has a growing economy and a ready supply of labor.

The tributary boundary of the Fort Collins-Loveland processing center is depicted on the map, Figure I-1. Inside of this tributary area is the Roosevelt National Forest and portions of the Arapaho, Routt and Medicine Bow National Forests as well as state and private land. The boundary was determined by using the information presented in the previous CSU study. In addition, the Fort Collins mills, the timber management office of the Roosevelt National Forest, and U.S. Forest Service appraisal reports for recent timber sales were consulted to confirm the tributary area boundary. Fort Collins-Loveland has rail service from the Burlington Northern and Union Pacific railroads. Major highways are U.S. 287, Colorado 14, and Interstate 25.

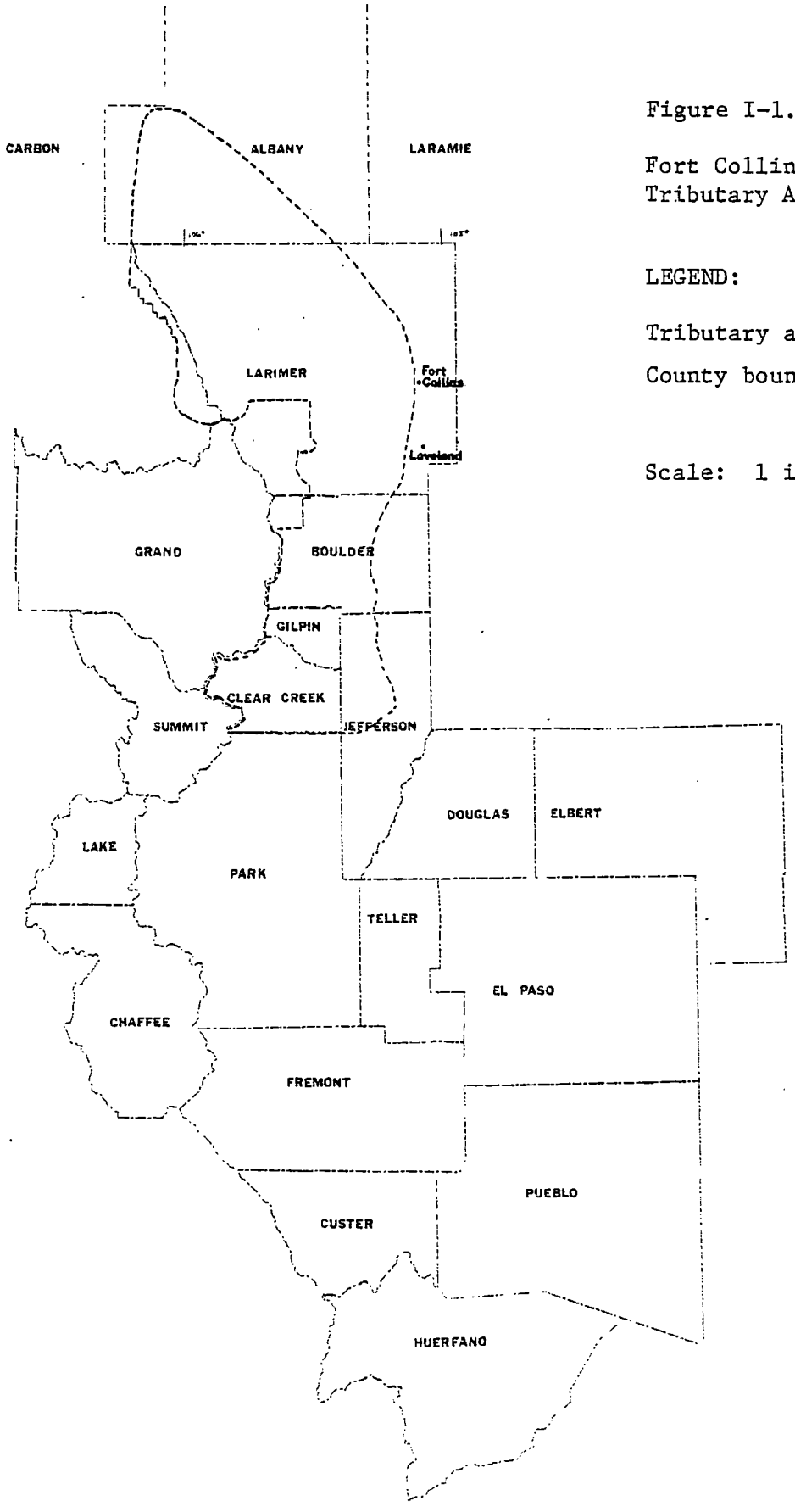

Figure I-1.

Fort Collins-Loveland Tributary Area

LEGEND:

Tributary area- - - -

County boundaries- · - - -

Scale: 1 inch = 34 miles

Time species of major commercial importance are spruce-fir, Douglas-fir, lodgepole pine, and ponderosa pine. In order to present a more complete picture of the timber available, data concerning aspen has also been compiled. However, aspen is not currently considered commercially important in this or any of the other processing centers included in this report.

In this case study, as in all of the other case studies, two adjustment factors were used to find available areas and volumes of timber within the boundaries of each tributary area. This factor was developed by using a dot grid to measure the acreage of a particular forest ownership lying within the tributary area boundary. For example, 5.4% of the Routt National Forest was within the tributary area. Therefore, .054 was the area adjustment factor used to adjust all areas and volumes of the Routt into the boundary.

The second adjustment factor was an accessibility adjustment factor. On national forest land, the standard and special component areas are those that are considered currently available for harvest and accessible. These two components are a percentage of either the total net national forest area or the commercial forest land on the national forest. This percentage, or accessibility factor, is used to adjust national forest areas and volumes so that they represent only standard and special components and those acreages which may be reclassified to standard or special components within the next five years. For example, 55% of the commercial forest land (CFL) on the Routt is classified as standard or special. The Routt National Forest acreages and volumes were first multiplied by 0.054 and then by .55 to estimate the area and volume that is currently available in the boundary. National forest and state and private lands were prorated by these same type factors when necessary, to show the acreages and volumes currently available within the boundary. This report assumes that all of the state and private land is accessible.

Live Timber

This section will interpret the area and volume information found in Table I-1.

All of the information for the Fort Collins-Loveland tributary area applies to the area within its boundary limits. Where a county or national forest was

Table I - 1

FORT COLLINS - LOVELAND TRIBUTARY AREA ACREAGE AND VOLUME OF LIVE TIMBER ON CFL LAND

	Boulder Co. T.R.I. #14		Gilpin Co. T.R.I. #14		Clear Creek Co T.R.I. #14		Larimer Co. T.R.I. #1		Colo. State Forest T.R.I. #8		Jefferson Co. T.R.I. #15		Albany Co. Wyo. Int-Forest Survey		Roosevelt N.F. 1975 Timber Inv.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber																
Spruce-fir type	5,700	18,285	2,100	7,850	5,400	14,412	N/A	N/A	3,200	32,040	0	0	N/A	N/A	25,281	69,612
Douglas-fir type	2,800	3,046	1,400	597	3,500	2,840	6,900	4,444	0	0	4,050	3,586	N/A		16,513	14,948
Lodgepole pine type	2,900	5,808	0	0	1,700	2,267	3,400	3,995	3,200	15,834	0	0	N/A		35,318	82,380
Ponderosa pine type	13,500	12,473	2,100	1,931	3,500	2,597	8,700	7,491	0	0	10,920	10,230	N/A		37,477	21,517
Aspen type	0	0	0	0	0	0	N/A	N/A	0	0	0	0	N/A		0	0
Total Sawtimber	24,900	39,612	5,600	10,378	14,100	22,116	19,000	15,930	6,400	47,874	14,970	13,816	32,500	38,596	114,589	188,457
Poletimber																
Spruce-fir type	1,000	2,465	2,800	4,608	4,400	8,208	N/A	N/A	7,300	8,443	510	1,316	N/A	N/A	3,830	6,398
Douglas-fir type	6,700	5,799	2,100	1,748	5,200	5,859	15,600	10,046	0	0	8,610	8,886	N/A	N/A	7,436	6,188
Lodgepole pine type	13,400	16,355	16,300	19,794	14,200	19,755	26,100	30,667	26,700	60,824	5,580	6,660	N/A	N/A	49,625	69,049
Ponderosa pine type	21,000	19,140	N/A	N/A	900	938	19,000	16,359	0	0	5,820	6,002	N/A	N/A	5,473	3,070
Aspen type	1,700	2,362	1,100	1,014	2,300	3,464	N/A	N/A	7,500	17,173	255	472	N/A	N/A	4,881	5,565
Total Poletimber	43,800	46,121	22,300	27,164	27,000	38,224	60,700	57,072	41,500	86,440	20,775	23,336	16,000	24,931	71,245	90,270
Seedling and Saplings																
Spruce-fir type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	947	118
Douglas-fir type	N/A	N/A	N/A	N/A	N/A	N/A	1,700	1,095			N/A	N/A	N/A	N/A	0	0
Lodgepole pine type	N/A	N/A	2,100	345	1,600	173	10,400	12,220			1,530	140	N/A	N/A	8,974	1,845
Ponderosa pine type	N/A	N/A	N/A	N/A	N/A	N/A	3,500	3,014			N/A	N/A	N/A	N/A	0	0
Aspen type	2,200	976	1,900	427	700	34	N/A	N/A			255	58	N/A	N/A	532	0
Total Seedling & Saplings	2,200	976	4,000	772	2,300	207	15,600	16,329	N/A	N/A	1,785	198	2,500	N/A	10,453	1,963
Rough																
Softwood																2,267
Hardwood																39
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.306
Rotten																
Softwood																8,618
Hardwood																586
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,204

Table I-1 (Continued)

FORT COLLINS - LOVELAND TRIBUTARY AREA LIVE CFL AREA

	Roosevelt N.F. By Species from 1979		Arapahoe N.F. 1975 TMP (Clear-Creek)		Arapahoe N.F. By Species 1979		Medicine Bow N.F. 1973 TMP		Routt N.F. 1973 TMP		Total of Table 1-1[4]	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber[1]												
Spruce-fir		60,673	6,240	19,550		5,497	17,174	N/A	5,462	10,510		
Douglas-fir		13,223	N/A	N/A		67	0	N/A	258	222		
Lodgepole pine		71,770	2,368	5,574		5,720	22,657	N/A	3,684	7,620		
Ponderosa pine type		20,568	0[2]	0[3]		0	0	N/A	0	0		
Aspen type		5,237	N/A	N/A		134	0	N/A	2,465	2,682		
Total Sawtimber	N/A	171,471	8,608	25,124	N/A	11,418	39,831	43,610	11,869	21,034	292,367	466,547
Poletimber[1]												
Spruce-fir		16,992	84	144		1,090	3,017	N/A	1,185	1,424		
Douglas-fir		9,233	N/A	N/A		10	0	N/A	0	0		
Lodgepole pine		76,851	879	1,774		2,968	8,898	N/A	1,502	2,670		
Ponderosa pine		3,746	0[2]	0[2]		0	0	N/A	0	0		
Aspen		3,230	N/A	N/A		179	0	N/A	2,326	2,346		
Total Poletimber	N/A	110,052	963	1,918	N/A	4,247	11,915	10,550	5,013	6,440	321,211	412,466
Seedling Saplings[1]												
Spruce-fir			286				4,068	N/A	2,639	610		
Douglas-fir			N/A				0	N/A	0	0		
Lodgepole pine			287				2,202	N/A	405	198		
Ponderosa pine			N/A				0	N/A	0	0		
Aspen			N/A				0	N/A	1,404	326		
Total Seedling Saplings	N/A	N/A	573	N/A	N/A	N/A	6,270	2,550	4,448	1,134	50,129	24,129
Rough												
Softwood								1,600		410		
Hardwood								0		162		
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,600	N/A	572	N/A	4,478
Rotten												
Softwood								900	N/A	436		
Hardwood								0		636		
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	900	N/A	1,072	N/A	11,176

(1) By forest type unless otherwise noted

(2) From Arapaho 1969 timber inventory

(3) Engelmann spruce only

(4) The totals and some of the subtotals of this table and other tables where noted, are not true sums for the tributary area. This is because in certain instances data were not available. Therefore, the totals are less than on the ground resources.

not entirely in the boundary an adjustment factor based on the proportion of land in the boundary was used. This adjustment factor was utilized to adjust areas and volumes of forested lands whose ownership was not entirely within the boundary. By using this prorated portion of each ownership's information, an assumption is made that species and stand-size classes are equally distributed throughout the entire land unit.

Information for the Arapaho National Forest was obtained from two sources -- the Timber Management Plan (TMP) and the computer printout sheets for the 1979 Resource Planning Act (RPA) projections. The TMP presents the volumes and acreages by forest type. The RPA presents volumes by species. By including both of these sources, inferences can be made as to the operability of the forest area and the accuracy of the data. The area adjustment applied to the RPA data was .18 and the accessibility factor was .36.

In the case of the Arapaho TMP no area or accessibility adjustment factors had to be applied since these data were broken down by district and the Clear Creek Ranger District was entirely within the boundary. However, adjustments were necessary in order to bring the TMP data into the format that was desirable for the taxonomy of this report. These adjustments included converting board feet to cubic feet (an adjustment of 5 board feet per cubic foot was used), and also a prorating adjustment for size class was necessary to determine acres of forest type for each size class. Also the acres of forest had to be multiplied by a volume per acre factor to arrive at the values in Table I-1. These are slightly different from the values published in the previous CSU report.

The data presented from the RPA source compare very favorably with the data from the TMP. There is comparatively less sawtimber in the RPA report because only the Engelmann spruce species is included. The TMP data includes the less valuable subalpine fir in the spruce-fir forest type. The values for lodgepole pine pole timber differ only slightly. This could be due to mixing of the lodgepole species into the other forest types or, more likely, a slight inaccuracy in the adjustment factors applied to the RPA data.

The entire Roosevelt National Forest was in the boundary so no area adjustment factor was necessary. Again, both an RPA and the TMP were utilized. The accessibility factor was determined from the TMP to be .43. Both the RPA and TMP have comparable volumes. This is newer and more accurate data than were available at the time of the previous CSU report.

The data from the Medicine Bow and the Routt National Forests were as presented in the previous CSU report. Since no new data have been made available, the only new action taken was to check the methodology of the old report. This was found to be accurate and the values in this study are the same as the old report. The area adjustment factors for Medicine Bow and Routt National Forests are .18 and .054 respectively. No accessibility factor was necessary for the Medicine Bow NF because the TMP reflects accessibility. The accessibility factor for the Routt NF was .55.

State and private information for living material was available in the Timber Resource Inventories (TRI) for Colorado counties. The areas and volumes for commercial forest land in counties tributary to Fort Collins, except for Jefferson County, were used in their entirety. The data presented in this report agree with the previous CSU report. Larimer County data in C.S.F.S. TRI No. 1 did not include volumes by species and stand-size class. These values were estimated from cubic feet/acre values implied in the TRI. The Jefferson County data were prorated using an area adjustment factor of .30 assuming an equal dispersion of ownership, stand-size class, and forest types. The TRIs data were only for commercial forest land.

The Colorado State Forest on the western edge of the Fort Collins-Loveland area is included in the tributary area. Information for the state forest is available in the Resource Management Plan for the Colorado State Forest and TRI No. 8 for Jackson County. The data for the state forest were taken solely from the TRI. The information in the TRI reflected commercial forest land areas and volumes whereas the Resource Management Plan did not.

Part of the Fort Collins-Loveland tributary area includes Albany County, Wyoming. Estimates of state and private land for the county were taken from the Intermountain Stations' Survey Unit's 1970 data for the county. State and private data are also available from the State Forester in Wyoming. However, the Survey Unit's information was in a more readily available form. The Intermountain Station figures are for commercial forest land without a breakdown by standard or special components. Thus, an assumption had to be made that species and ownerships were evenly distributed. A boundary adjustment factor of .50 was used to define the areas and volumes of Albany County which were within the boundary. Only total areas and volumes for stand-size classes were available for the county. The TRIs and Intermountain Station county data were the best available sources from which state and private information could be obtained.

Rough and rotten timber estimates were available in the preliminary TMPs for the Medicine Bow and Routt National Forests. The Roosevelt NF rough and rotten data were obtained from the timber management staff. Information for this category was not available for the Arapaho NF. The volumes of rough and rotten timber were prorated with boundary and availability factors when necessary. As in the previous CSU report no rough and rotten data were found for state and private timbered areas.

Dead Timber

Data on dead timber is presented in Table I-2 with its attendant subheadings. It is structured after the taxonomical scheme in the introduction of this report. Limited information was available in the general category of dead material.

There were two sources of information that provided salvageable dead data for the national forests. The Roosevelt and Arapaho NF data were obtained from the RPA printouts. This represents new information not included in the previous CSU report. The dead volumes reported for the Routt and Medicine Bow NF were the same values as in the previous study. The same adjustment factors as in the live material case were used to prorate the information into the tributary area for the savageable dead category.

Salvageable dead information for spruce-fir was obtained from a study, Demonstration Test of Inwoods, Pulp Chip Production in the Four Corners Region, Sampson, etal, RM 125, that found 831 cubic feet/acre of standing and down dead spruce-fir material in Southern Colorado. This figure was applied to the acreages of spruce-fir sawtimber, poletimber, and seedlings and saplings given in the living material table. Therefore, the total salvageable dead spruce-fir reflects the volume that is considered currently available. This cubic feet/acre figure was used when no other spruce-fir standing or down dead data were available.

Standing dead volumes are available for each national forest in this report. However, because no standing or down dead volumes are listed for the counties, the figure above was utilized to find these values for each county. Salvageable dead volumes of aspen were not recorded for the Medicine Bow NF because aspen is unregulated, or currently unavailable.

Table I-2

FORT COLLINS - LOVELAND TRIBUTARY AREA: DEAD MATERIAL[1] PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL[2]

	Boulder Co.		Gilpin Co		Clear Creek Co.		Larimer Co.		Jefferson Co.		Roosevelt N.F. R.P.A.		Arapaho N.F.[4] Timber Inventory		Medicine Bow[4] N.F.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 Year Mortality (Standing)																
Spruce-fir type		5,567		4,071		8,142	N/A	N/A		423		245[3]		1,801		
Douglas-fir type		N/A		N/A		N/A	N/A	N/A		N/A		912		0		
Lodgepole pine type		N/A		N/A		N/A	N/A	N/A		N/A		1,593		625		4,550
Ponderosa pine type		N/A		N/A		N/A	N/A	N/A		N/A		3,301				
Aspen type		N/A		N/A		N/A	N/A	N/A		N/A		46		30		
Total 5 year mortaligy	N/A	5,567	N/A	4,071	N/A	8,142	N/A	N/A	N/A	423	N/A	6,097	N/A	2,456	N/A	4,550
Sound Dead (Down)																
Spruce-fir type		N/A		N/A		N/A		N/A		N/A		2,804[3]		2,483		N/A
Douglas-fir type		N/A		N/A		N/A		N/A		N/A		205				N/A
Lodgepole pine type		13,448		13,448		13,118		24,338		4,604		9,951		2,193		13,786
Ponderosa pine type		N/A		N/A		N/A		N/A		N/A		1,357				N/A
Aspen type		N/A		N/A		N/A		N/A		N/A		472		33		N/A
Total Sound Dead	N/A	13,448	N/A	13,448	N/A	13,118	N/A	24,338	N/A	4,604	N/A	14,789	N/A	4,709[4]		13,786
Non C.F.L. Lands[1]																
Live	N/A	17,303	N/A	3,509		6,231		94,198		26,559		95,469		40,903		7,425
Dead	N/A	315	N/A	64		113		1,713		483		1,736		745		135
Total Non CFL	28,600	17,618	5,800	3,573	10,300	6,344	155,700	95,911	43,900	27,042	157,800	97,205	67,608	41,648	12,272	7,560
	# of stems		# of Stems		# of stems		# of stems		# of stems		# of stems		# of Stems		Stems	
PP beetle kill mortality[6]		[5]														
Ponderosa pine 1977	116,400	1,222.2	1,800	18.9	7,200	75.6	74,500	782.25	98,000	1,029	152,300	1599.15	800	8.4		
Ponderosa pine 1976	116,400	1,222.2	1,800	18.9	7,200	75.6	74,500	782.25	98,000	1,029	152,300	1599.15	800	8.4	0	0
Total Ponderosa pine Mortality	232,800	2,444.4	3,600	37.8	14,400	151.2	149,000	1564.50	196,000	2,058	304,600	3198.30	1,600	16.4	0	0

(1) spruce fir standing dead from 831 Ft^3/acre for standing & down dead

(2) non CFL conifers in counties. assumed to be 605/ft^3/AC live material, 11/ft^3/AC dead material. Vol/AC factors from Manitou Expe. forest; 23 plots on non-CFL land. The CSFS definition of non CFL-forest land that is not capable of yielding usable wood products due to adverse site conditions, including physical inaccessibility. Land that does not meet the following qualifications: (1) either 1500 B.F. or 600 ft^3/AC and 40 B.A. 40% crown cover or more. This classification includes non-CFL. lands of all forest types in Jefferson County 900 acres are pinon-Juniper in Clear Creek 1800 acres are P.-J. types

(3) spruce only

4. From previous CSU report
5. Uses - stem count by CSFS 100% coverage
6. Computed by multiplying # of stems killed each year x 10.5 factor
7. Refer to Footnote 4 on Table I-1.

Table I-2 (Continued) FORT COLLINS-LOVELAND TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON CFL MATERIAL

	CO State Forest[4]		Routt N.F. 1973 TMP		Total of Table I-2 (7)	
	Acres	MCF	Acres	MCF	Acres	MCF
5 Year Mortality (Standing)						
Spruce-fir type		8,724				
Douglas-fir type		N/A				
Lodgepole pine type		N/A		1,230		43,018
Ponderosa pine type		N/A				
Aspen type		N/A		26		
Total 5 year Mortality	N/A	8,724	N/A	1,256	N/A	41,266
Sound Dead (Down)						
Spruce-fir type		N/A		N/A		
Douglas-fir type		N/A		N/A		
Lodgepole pine		24,668		4,278		
Ponderosa pine type		N/A		N/A		
Aspen type		N/A		N/A		
Total Sound Dead	N/A	24,668	N/A	4,278	N/A	131,186
Non CFL Lands						
Live	N/A	1,936	N/A	532	N/A	
Dead	N/A	35	N/A	10	N/A	
Total Non-CFL	3,200	1,971	879	542	486,059	299,412
PP Beetle Kill Mortality						
Ponderosa pine 1977	0	0	0	0		
Ponderosa pine 1976	0	0	0	0		
Total PP Beetle Kill Mortality	0	0	0	0	902,000	9,472

The amount of lodgepole pine down material was based on the Reducing Fire Potential in Lodgepole Pine by Increasing Timber Utilization, Brown, J. K., publication INT-181, for down dead material. The down dead lodgepole pine volume in western Wyoming was estimated as 825 c. ft./acre. This volume figure was used to estimate volume of down dead in all lodgepole pine stands in the area of concern. The acres of lodgepole pine sawtimber and poletimber in Table I-1 for each ownership were used to arrive at the total down dead volume. Since the acreages in Table I-1 reflect an estimate of the land area that is currently available, the down dead volume of lodgepole pine is also available.

Table I-2 includes data for non-CFL lands. Much of the beetle kill mortality occurs on non-CFL land making this category important to the study. Unfortunately data are very limited in this area since little inventory work has been accomplished for non-CFL land. Acreages of non-CFL land were obtained from TMPs for the national forest and from the TRI summary report for the state and private lands. By applying a volume per acre factor of 605 cubic foot live timber per acre and 11 cubic foot of dead material per acre, volumes were estimated for each forest ownership. The above volume per acre factors were derived from an average of plots taken on non-CFL land in the Manitou Experimental Forest. This information was supplied by the Rocky Mountain Forest and Range Experiment Station. These volumes may be questioned since the 605 cubic feet per acre figure is commercial forest land by the CSFS definition (See the Glossary included in the study). Federal, state and private non-CFL are combined in this report. Where the information is available, the forest type makeup of the non-CFL is noted in the footnotes of Table I-2. On state and private non-CFL land it is probably safe to assume most of this land is ponderosa pine because the state and private lands are mostly located at lower elevations. No information was available as to forest type makeup for federal non-commercial forest lands.

The ponderosa pine beetle kill mortality was obtained from stem counts by the USFS and CSFS 1976 aerial surveys. The CSFS air survey was used for Boulder County since it was a 100% coverage survey. The USFS survey was about 40 percent according to the Regional Office, Insect and Disease Section, a blowup or "sampling" factor of 2.5 had to be multipled times the number of stems shown on their survey map. In the region of the Fort Collins-Loveland tributary area a build-up ratio of one to one (1:1) is applied to predict the number of trees to be killed in 1977. This build-up ratio was also supplied by the Regional

Office. The Regional office also supplied the average DBH and height of beetle killed trees in the Fort Collins-Loveland tributary area. The average DBH is 9.59 inches. The average height is 55 feet using C. Myers' (Research paper RM-2) volume tables for southwestern ponderosa pine. An average stem thus represents 10.5 cubic feet of wood. This 10.5 cu. ft./stem figure was multiplied times the number of stems killed in 1976 and 1977 to give the wood volume mortality for two years caused by the mountain pine beetle.

Potential Yield and Programmed Current Cut

The NF information in the TMPs lists potential yield and programmed current cuts for the standard and special components. A boundary adjustment factor was used when necessary to prorate the future cut figures into the boundary area. These are shown in Table I-3. State and private potential cuts are based on figures supplied by the CSFS.

On the national forests the TMPs reflect the only volumes of sawtimber scheduled for cutting and potential cutting. The state supplied information for potential yield including both sawtimber and poletimber volumes. However, no information was available throughout the Front Range for current cut volumes on private lands.

Acreages of timber to be cut on national forests are given for a ten-year period. Since some of the acres may be re-entered during the ten-year period to receive additional treatment (i.e., shelterwood cuttings), the volumes are tablulated on an annual basis. The appropriate area adjustment factors were applied to the TMP values. No accessibility adjustment was necessary since the data were tabulated by standard and special components.

The information included under the subheading in Table I-3, Potential Volume From Ponderosa Pine Thinnings, is computed by thinning all of the sawtimber stands and 25% of the pole timber stands to a growing stock level of 80. The volume that would be generated by this removal is approximately 300 cu. ft./acre. This volume per acre figure was derived by using estimates of a number of professional foresters. By taking the number of ponderosa sawtimber acres and 25% of the poletimber acres and multiplying the sum of these two acreages by 300 cubic feet per acre the total volume of wood that could be removed was computed. This volume is divided by 5 years, which is the time period the Regional

Table I-3 ANNUAL POTENTIAL YIELD AND PROGRAMMED CURRENT CUT FOR FT-COLLINS - LOVELAND TRIBUTARY AREA

	Roosevelt N. F.[1] Sawtimber		Routt N.F.[2] Sawtimber		Arapaho N.F.		Medicine Bow N.F. Sawtimber		State & Private		Total[11] for Table I-3	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Potential yield												
Standard	14,000	5,367	3,340	545	5,542	398	11,254	13,576	Sawtimber---2,252			
Special	240[9]	93	65	6	4,890[9]	174	510	337	Poletimber 3,758			
Total	14,240[9]	5,460	3,405	551	10,432[9]	572	11,764	13,913	N/A	6,010[8]	39,841	26,506
Current Cut												
Allowable cut												
Standard	2,117[6]	1,347[6]	385	411	292[6]	359	782	932				
Special	820	1,500	20	16	146	101	170	144				
Total	2,938	2,847	405	427	438	460	952	1,076	N/A	915.5[4]	4,732	5,725
Potential Vol from Ponderosa[3] Pine Thinnings/yr												
Sawtimber	37,477	2,249	0	0	0	0	0	0	38,720[7]	2,323[7]	76,197	4,572
Poletimber	1,368	82	0	0	0	0	0	0	11,680	701	13,048	783
Total	38,845[10]	2,331	0	0	0	0	0	0	50,400	3,024	89,245	5,355

(1) Effective period Fy 76 through 85
(2) For sawtimber volumes only
(3) Computed by multiplying 300 Ft^3/AC times acres of accesible ponderosa pine land and dividing by 5 years, 25% of existing poletimber is thinned, 100% of the sawtimber is thinned.
(4) From previous CSU report. Includes Boulder and Larimer counties only
(6) From Fy. 76 programmed harvest statement, this would vary from year to year
(7) Does not include values for Albany CO and seed/sapling acres + volumes. For the entire tributary areas.
(8) For Colorado State & private lands only
(9) Acres to be cut over a ten year period
(10) Acres to be thinned over a 5 year period
(11) Refer to footnote (4) of Table I-1.

office specifies for the ponderosa pine thinning program. This figure is the potential volume per year that would be generated by the thinnings. The reason only 25% of the poletimber is thinned is that according to the Regional office about 25% of mountain pine beetle infestations are occurring in the poletimber stands. Therefore, according to the Regional office 25% of the poletimber stands ought to be thinned. The Regional office recommended 25% as an estimate until more data is available. It should be noted that at present the potential thinnings in ponderosa pine greatly exceed what is presently being harvested from the ponderosa pine forest type. In fact in most cases, the potential volumes that could be generated by thinning the ponderosa pine forest type alone almost equal the current cut for all forest types.

Wood Processor Information

To gain an overall view of the wood utilization at the two sites, representatives of the wood product industries were visited. Information regarding product volumes, costs and values were used to aid in determining the economic availability of all raw materials at each site.

Informal conversations were held with producers of primary products at each of the two sites involved in this case study. These producers are listed in Table I-4. In order not to divulge any information based on the operation of an individual company, production cost, and value data from the two sites have been aggregated in Table I-5.

Product volumes, costs and values were thus obtained for the December 1976 period. The products listed in the table are those which are currently or potentially could be produced in the Fort Collins-Loveland processing area. In order that these values may be more meaningful, they are presented in thousand board feet and thousand cubic feet units along with the cost for each piece of a given product when appropriate.

The existing wood utilization capacity to produce various types of wood products is presented in Table I-6. This table assumes that the present day mills are operating 240 days per year and 8 hours a day at maximum efficiency. The term "present day mills" means all wood processors including full time and seasonal mills, as well as those mills that are presently idle.

Table I-4. Wood Processors in the Fort Collins-Loveland Processing Area which make up the existing utilization capacity.

Cook Lumber
Roy Seymour, Manager
P.O. Box 553
Fort Collins 80521

Fay Crutchfield
4517 North U.S. Highway 287
LaPorte 80535

Mountain View Lumber
Fred Bockman
Route 3, Box 789 (Bellvue)
Fort Collins 80521

Clifford O. Bettington
Route 2, Box 321F
Loveland 80537

William E. F. Smith
Start Route Box 362
Loveland 80537

Ross Whistler
Box 195
LaPorte 80535

Mark Fraiser
Rist Canyon
Bellvue 80512

V.O. Augustine
Bellvue, 80512

Lincoln Log Co.
Jim Epp
LaPorte 80535

Westridge Fence Co.
Ray Nicholson
Route 3, Box 789 (Bellvue)
Fort Collins 80521

7 Firewood producers

Table I-5. Fort Collins-Loveland Product Values (F.O.B. Mill).

Product	Dollars Each	Dollars MBF of finished product	Dollars MCF of finished product
Pallets	$5.00/pallet	$250	$3000
Timbers (treated)	6.00/timber	310	3720
Fencing	.50-.60/piece	270	3240
Dimension lumber		220	2640
Railroad ties	6.00/tie	310	3720
Barn poles	13.20/piece	280	3360
House logs (tongue & grooved)	10.40/piece	155	1860
Corral poles	2.25/piece	240	2880
Fence posts	1.45/piece	281	3372
Rough boards		150	1800
Planed boards		200-210	3657-3840
Studs		180	3291
Panelling		300	5485
Firewood	50.00/cord	49	588
Chips	6.00/ton	-	75
Shavings	6.00/ton	-	75
Sawdust	6.00/ton	-	75

Table I-6. Existing wood product utilization capacity -- Fort Collins-Loveland[1/]

Mill Capacity (MCF/year)		Products
234.6		Pallets
52.7		Treated timbers
201.4		Fencing
443.8		Boards (rough)
624.8		Boards (planed)
200.8		Houselogs
156.7		Barn poles
330.9		Corral poles
332.6		Fence posts
77.4		Panelling
27.4		Dimension lumber
70.8		Studs
214.2		Firewood
19.5		Railroad ties (decorative)
2987.6		Total capacity
1114.6	By-products:	Chips
544.3		Sawdust
205.4		Shavings
1864.3		Total by-products

1/ Based on finished product volumes, assuming every mill operated at maximum efficiency 8 hours a day, 240 days per year.

The costs of delivering the raw materials to the processing area are included in Table I-7. These costs are presented by size class with a low, average and high figure based on the characteristics of the Fort Collins-Loveland tributary area. These costs were developed using USFS appraisals of timber sales that actually sold in the 1975-1976 period. These appraisals utilize the current Region 2, 2400 Manual figures. The mills were also consulted to confirm these costs. Unfortunately, mills or wood processors were not able to accurately cite their costs. Therefore, for a lack of a better source of information the appraisals were strongly relied upon. It seems that the appraisers had a better estimate of costs than other sources despite appraisal shortcomings such as the use of cost figures derived from other locales.

The Fort Collins-Loveland tributary area has an average transportation network. Albany County is below average in accessibility; Boulder County is above average in its transportation characteristics and the remaining counties within the tributary area are average. Refer to Table 3 in the Summary for the area of concern for miles of each road classification within each county.

Population figures for the Fort Collins-Loveland processing area along with growth projections and transportation facilities for marketing purposes is included in Tables I-8 and I-9.

Table I-7. Costs of Delivering Raw Materials, Fort Collins-Loveland Processing Area[1].

	Lowest Cost	Average Cost	Highest Cost
Stumpage (Sawtimber)	$2.00/MBF[2]	$11.58/MBF	$25.27/MBF
Stumpage (Fuelwood)	.50/cord	.50/cord	.50/cord
Stumpage (Poles)	.50/cord	.50/cord	.50/cord
Harvesting (Sawtimber)	40.30/MBF[3]	42.26/MBF	51.08/MBF
Harvesting (Poles)	19.12/cord	19.19/cord	19.28/cord
Transportation Costs to F.C.-Loveland			
Sawtimber	19.69/MBF	22.60/MBF	25.86/MBF
Poles	11.48/cord	11.76/cord	12.33/cord
Fuelwood	9.97/CCF	9.97/CCF	9.97/CCF
Total Delivering Costs[4]			
Sawtimber	67.01/MBF[3]	90.01/MBF	106.99/MBF
Pole timber	37.58/cord	39.40/cord	43.01/cord

[1]Taken from ten 1975-1976 USFS appraisals that sold, sales are assumed to be approximately the same size in volume

[2]Net indicated average stumpage as low as $-56.79 (negative).

[3]Includes cull and firewood

[4]Includes profit and risk (Avg. 11%)

Table I-8

Fort Collins-Loveland Population

	Fort Collins[1]	Loveland[2]	Larimer County[1]
1970	43,337	23,000	89,000
1975	55,825	29,400	118,450
1980	79,860	32,400	143,000

Sources:

[1]"Profile 1976: Fort Collins, Colo.", First National Bank

[2]"Loveland, Colorado Statistics", Loveland Chamber of Commerce. (Population based on jurisdictional limits.)

Table I-9

Fort Collins-Loveland Transportation Facilities

Motor Freight Carriers

1. TWX Truck Lines
   Transfer and Warehouse Facilities
   Home Base: Denver

2. Miller Bros.
   Transfer and Warehouse Facilities
   Home Base: Denver

3. Bethke Truck
   No Transfer or Warehouse Facilities
   Home Base: Gilcrest

4. Globe Truck
   No Transfer or Warehouse Facilities
   Home Base: Denver

Freight Service

1. Union Pacific
   Switching Hours: 10:00am - 8:00 pm (7 days/week)
   One train daily
   Yard capacity (cars) is 200.

2. Colorado & Southern
   Switching Hours: 8:00am - 8:00pm (7 days/week)
   Four trains daily
   Yard capacity is two yards, "good size"

Source:

"Fort Collins, Colorado, an Economic Overview - 1975" United Banks of Colorado.

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3. Brown, J. K. 1974. Reducing Fire Potential in Lodgepole Pine by Increasing Timber Utilization, INT-181. Intermountain Forest and Range Experiment Station, Ogden, Utah.

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16. USDA Forest Service. 1974. Working Papers of Timber Management Plan. Routt National Forest. Region 2 Office, Denver, Colorado.

17. USDA Forest Service. Forest Survey Unit. Intermountain Forest and Range Experiment Station. Ogden, Utah.

18. USDA Forest Service. 1975. Title 2400 Timber Management: Region 2 Supplement No. 197. Region 2 Office. Denver, Colorado.

Agencies Consulted

1. Boulder County Forestry Department, Longmont, Colorado.
2. CSFS. State Office. Fort Collins, Colorado.
3. CSFS. Fort Collins District. Fort Collins, Colorado.
4. CSFS. Golden District Office. Golden, Colorado.
5. CSFS. Boulder District Office. Longmont, Colorado.
6. Department of Commerce. Fort Collins and Loveland, Colorado.
7. Larimer County, Week and Pest Department. Fort Collins, Colorado.
8. USDA Forest Service. Arapaho-Roosevelt Supervisors Office. Fort Collins, Colorado.
9. USDA Forest Service. Rocky Mountain Experiment Station, Fort Collins, Colorado.
10. USDA Forest Service, Regional Office. Denver, Colorado.
11. USDI Bureau of Land Management, State Office. Denver, Colorado.
12. USDI. Bureau of Land Management, Canon City District Office, Canon City, Colorado.

Since many of the references throughout this report are repeated in the case studies, the following studies will cite by the number assigned in this case study.

Case Study II: Boulder-Longmont Processing Area

Summary

The Boulder-Longmont tributary area has 784,609 mcf of living raw material within the boundary. This information was acquired from the same sources utilized in the Fort Collins-Loveland case study. The same procedures and adjustment factors were employed with the exception that Wyoming lands are not included within this tributary area.

The total five year mortality volume is 36,760 mcf and the total sound dead volume is 117,400 mcf. The mortality due to mountain pine beetle damage was 4,736 mbf in 1976. This is the same mortality of the Fort Collins-Loveland tributary area since very little ponderosa pine is being lost to the beetle in Wyoming. The total non-CFL volume is 344,339 mcf. The total annual potential cut is 12,593 mcf with a current annual cut of 4,649 mcf. If the ponderosa pine forests were thinned according to the cutting strategy described in the methodology section of this report 5,355 mcf/year would be available.

The mill capacity of the Boulder-Longmont mills is 1,254 of mcf/year, assuming that mills ran at maximum efficiency 8 hours/day, 240 days/year. This would also produce 692.8 mcf of by-products per year. These by-products are not currently being used for pulp. Average production costs and product values were also gathered. Only limited data were available concerning costs. The total delivery costs of raw material to Boulder-Longmont was $92.36/mbf of sawtimber and $46.38/ccf of fuelwood.The average value for rough cut lumber was $150/mbf.

The Boulder-Longmont processing area has a population of 108,500 with an uncertain growth rate. The transportation system in Boulder County is good with characteristics of slightly above average.

Introduction

This report examines the total wood raw material available to the cities of Boulder and Longmont. The boundary of the Boulder-Longmont tributary area is depicted in Figure II-1. In the confines of this area are the Roosevelt National Forest and portions of the Arapaho National Forest as well as state and private land.

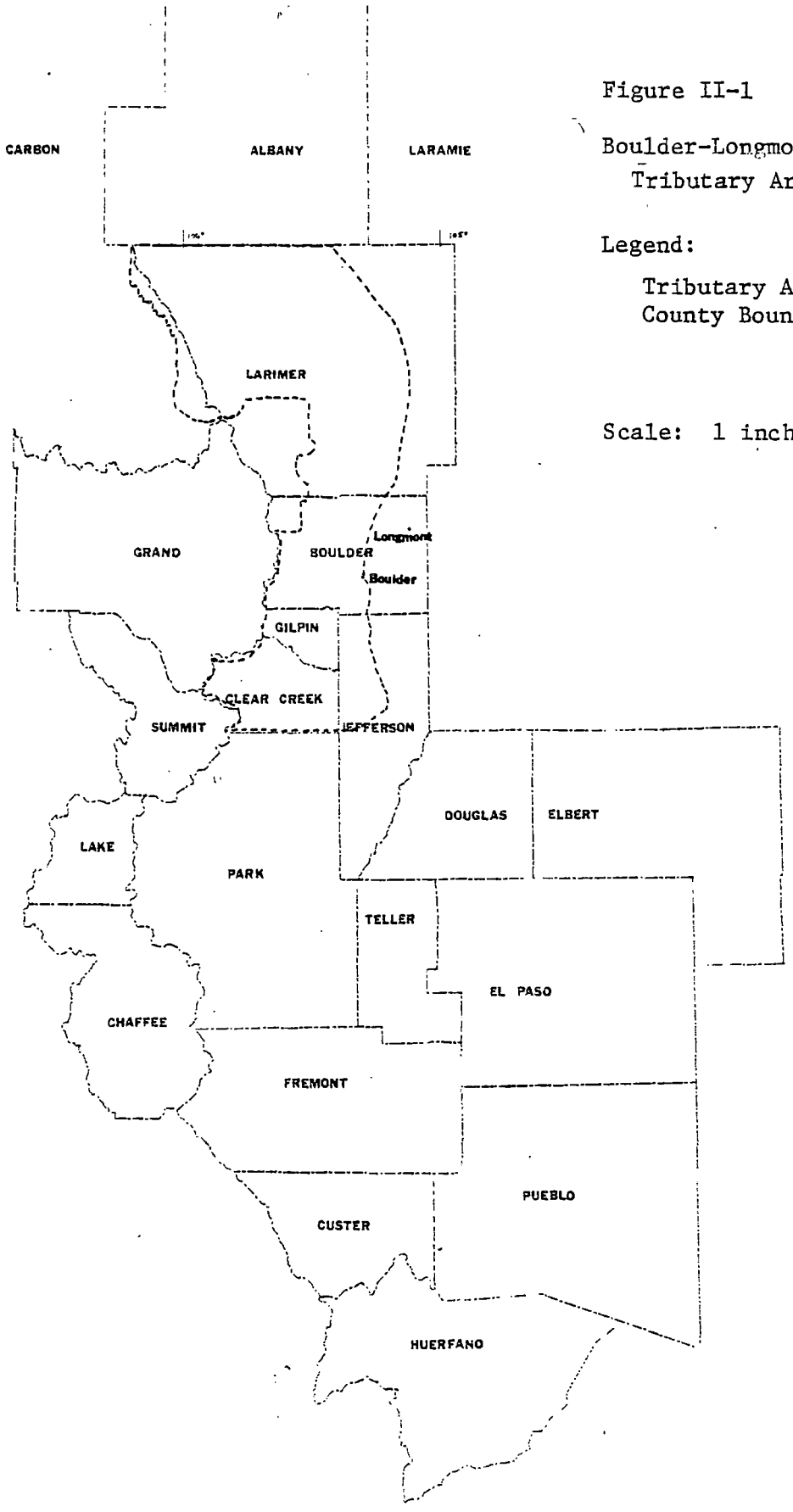

Figure II-1

Boulder-Longmont
Tributary Area

Legend:

Tributary Area Boundry ---
County Boundry -·-·-·-

Scale: 1 inch = 34 miles

The transportation network within Boulder County is good. There is an adequate amount of quality forest roads and major highways. The rail service includes the Chicago, Burlington and Quincy Railroad and the Colorado and Southern Railroad. The major highways are Colorado 119, 72 and 7 and Interstate 25.

This case study is similar to the Fort Collins-Loveland study. It differs in that the Medicine Bow and Albany County private lands do not reside within the Boulder-Longmont tributary area. With that exception the same procedures and adjustment factors are used as in the Fort Collins-Loveland study. After consulting with industry and various U.S.F.S. offices, it was decided that the Boulder-Longmont tributary area is similar to the Fort Collins-Loveland tributary area except for the northern portion of the Fort Collins-Loveland area.

Living Raw Material

This section will interpret the area and volume information found in Table II-1. Since much of the area in this case study is included in the Fort Collins-Loveland area, that case study should be of particular value as a reference.

The necessary area and accessibility adjustment factors were applied to the National Forest lands included within this tributary area. Since no new sources of data were acquired for this study basically the same assumptions made in the Fort Collins-Loveland study are made here.

Dead Raw Material

The dead material is detailed on Table II-2. As in the Fort Collins-Loveland there were areas in which no data were directly available. The usual dead volume per acre factors were applied. Again the same procedure was applied with the exception of not including the Medicine Bow N.F. or the Albany County, state, B.L.M. and private lands.

Potential Yield and Programmed Current Cut

The national forest TMPs list potential yields and annual programmed cuts which vary from year to year. The state cuts are CSFS estimates. These are the same sources as utilized in the Fort Collins-Loveland study. The cut for the Medicine Bow N.F. is not included in this study. The cut for state and private lands is identical for the Fort Collins-Loveland study because no information

Table II-1

BOULDER-LONGMONT TRIBUTARY AREA LIVE CFL LAND

	Boulder Co. TRI #14		Gilpin Co. TRI #14		Larimer Co. TRI #1		Clear Creek Co. TRI #14		Jefferson Co. TRI #15		Colo State For. TRI #8		Roosevelt N.F. 1975 Timber Inv.		Roosevelt N.F. Species from 1979 RPA	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber																
Spruce-fir type	5,700	18,285	2,100	7,850	N/A	N.A	5,400	14,412	0	0	3,200	32,040	25,281	69,612		60,673
Douglas-fir type	2,800	3,046	1,400	597	6,900	4,444	3,500	2,840	4,050	3,586	0	0	16,513	14,948		13,223
Lodgepole pine type	2,900	5,808	0	0	3,400	3,995	1,700	2,267	0	0	3,200	15,834	35,318	82,380		71,770
Ponderosa pine type	13,500	12,473	2,100	1,931	8,700	7,491	3,500	2,597	10,920	10,230	0	0	37,477	21,517		20,568
Aspen type	0	0	0	0	N/A	N/A	0	0	0	0	0	0	0	0		5,237
Total Sawtimber	24,900	39,612	5,600	10,378	19,000	15,930	14,100	22,116	14,970	13,816	6,400	47,874	114,589	188,457	N/A	171,471
Poletimber																
Spruce-fir type	1,000	2,465	2,800	4,608	N/a	N/A	4,400	8,208	510	1,316	7,300	8,443	3,830	6,398		16,992
Douglas-fir type	6,700	5,799	2,100	1,748	15,600	10,046	5,200	5,859	8,610	8,886	0	0	7,436	6,188		9,233
Lodgepole pine type	13,400	16,355	16,300	19,794	26,100	30,667	14,200	19,755	5,580	6,660	26,700	60,824	49,625	69,049		76,851
Ponderosa pine type	21,000	19,140	N/A	N/A	19,000	16,359	900	938	5,820	6,002	0	0	5,473	3,070		3,746
Aspen type	1,700	2,362	1,100	1,014	N/A	N/A	2,300	3,464	255	472	7,500	17,173	4,881	5,565		3,230
Total poletimber	43,800	46,121	22,300	27,164	60,700	57,072	27,000	38,224	20,775	23,336	41,500	86,440	71,245	90,270	N/A	110,052
Seedling and Saplings																
Spruce-fir type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/a			947	118		
Douglas-fir type	N/A	N/A	N/A	N/A	1,700	1,095	N/A	N/A	N/A	N/A			0	0		
Lodgepole pine type	N/A	N/A	2,100	345	10,400	12,220	1,600	173	1,530	140			8,974	1,845		
Ponderosa pine type	N/A	N/A	N/A	N/A	3,500	3,014	N/A	N/A	N/A	N/A			0	0		
Aspen type	2,200	976	1,900	427	N/A	N/A	700	34	255	59			532	0		
Total Seedling & Sapling-	2,200	976	4,000	772	15,600	16,329	2,300	207	1,785	199	N/A	N/A	10,453	1,963	N/A	N/A
Rough°																
Softwood														2,267		
Hardwood														39		
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,306	N/A	N/A
Rotten°																
Softwood														8,618		
Hardwood														586		
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,204	N/A	N/A

Table II-1 (continued) BOULDER-LONGMONT TRIBUTARY AREA LIVE CFL LAND

	Arapahoe N.F. 1975 TMP (Clear Creek)		Arapahoe N.F. By Species 1975 RPA[4] Clear Creek R.D.		Routt N. F. 1973 TMP		Total Of Table II-1[5]	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber[1]								
Spruce-fir	6,240	19,550		5,497[3]	5,462	10,510		
Douglas-fir	N/A	N/A		67	258	222		
Lodgepole pine	2,368	5,574		5,720	3,684	7,620		
Ponderosa pine type	0[2]	0[3]		0	0			
Aspen type	N/A	N/A		134	2,465	2,682		
Total Sawtimber	8,608	25,124	N/A	11,418	11,869	21,034	220,036	384,341
Poletimber[1]								
Spruce-fir	84	144		1,090[3]	1,185	1,424		
Douglas-fir	N/A	N/A		10	0	0		
Lodgepole pine	879	1,774		2,968	1,502	2,670		
Ponderosa pine	0[2]	0[2]		0	0	0		
Aspen	N/A	N/A		179	2,326	2,346		
Total Poletimber	963	1,918	N/A	4,247	5,013	6,440	293,296	368,535
Seedling Saplings[1]								
Spruce-fir	286				2,639	610		
Douglas-fir	N/A				0	0		
Lodgepole pine	287				405	198		
Ponderosa pine	N/A				0	0		
Aspen	N/A				1,404	326		
Total Seedling Saplings	573	N/A	N/A	N/A	4,448	1,134	41,359	21,579
Rough								
Softwood						410		
Hardwood						162		
Total Rough	N/A	N/A	N/A	N/A	N/A	572	N/A	2,878
Rotten								
Softwood						436		
Hardwood						636		
Total Rotten	N/A	N/A	N/A	N/A	N/A	1,072	N/A	10,276

(1) By forest type unless otherwise noted

(2) From Arapaho 1969 Timber Inventory

(3) Engelmann spruce only

(4) Area & Accessability factory applied (.0139)

(5) Refer to Footnote 4 on Table I-1.

Table II-2 BOULDER-LONGMONT TRIBUTARY AREA; DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL

	Boulder Co		Gilpin Co		Clear Creek Co		Larimer Co		Jefferson Co.		Roosevelt N. F.[3] RPA		Arapaho N.F.[3] RPA		State Forest	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 year Mortality (Standing)																
Spruce-fir type		5,567		4,071		8,142	N/A	N/A		423		245[2]		1,801		8,724
Douglas fir type		N/A		N/A		N/A	N/A	N/A		N/A		912		0		N/A
Lodgepole pine type		N/A		N/A		N/A	N/A	N/A		N/A		1,593		625		N/A
Ponderosa pine type		N/A		N/A		N/A	N/A	N/A		N/A		3,301		0		N/A
Aspen type		N/A		N/A		N/A	N/A	N/A		N/A		46		30		N/A
Total 5 year mortality	N/A	5,567	N/A	4,071	N/A	8,142	N/A	N/A	N/A	423	N/A	6,097	N/A	2,456[4]	N/A	8,724
Sound Dead (Down)																
Spruce-fir type		N/A		N/A		N/A		N/A		N/A		2,804[2]		2,483		N/A
Douglas-fir type		N/A		N/A		N/A		N/A		N/A		205				N/A
Lodgepole pine type		13,448		13,448		13,118		24,338		4,604		9,951		2,193		24,668
Ponderosa pine type		N/A		N/A		N/A		N/A		N/A		1,357				N/A
Aspen type		N/A		N/A		N/A		N/A		N/A		472		33		N/A
Total Sound Dead	N/A	13,448	N/A	13,448	N/A	13,118	N/A	24,338	N/A	4,604	N/A	14,789	N/A	4,709[5]	N/A	24,668
Non CFL Lands[1]																
Live	N/A	17,303	N/A	3,509	N/A	6,231	N/A	94,198	N/A	26,559	N/A	95,469	N/A	40,903	N/A	1,936
Dead	N/A	314	N/A	64	N/A	113	N/A	1,713	N/A	483	N/A	1,736	N/A	745	N/A	35
Total Non CFL	28,600 # of Stems	17,617	5,800 # of Stems	3,573	10,300 # of Stems	6,344	155,700 # of Stems	95,911	43,900 # of Stems	27,042	157,800 # of Stems	97,205	67,608 # of Stems	41,648	3,200 # of Stems	1,971
P. P. Beetle Kill Mortality																
Ponderosa pine 1977	116,400	1,222.2[7]	1,800	18.9	7,200	75.6	74,500	782.25	98,000	1,029	152,300[8]	1,599.15	800	8.4	0	0
Ponderosa pine 1976	116,400	1,222.2	1,800	18.9	7,200	75.6	74,500	782.25	98,000	1,029	152,300	1,599.15	800	8.4	0	0
Total ponderosa pine mortality	232,800	2,444.4	3,600	37.8	14,400	151.2	149,000	1564.50	196,000	2,058	304,600	3,198.30	1,600	16.4	0	0

Non CFL conifers in counties. Assumed to be 605/Ft^3/AC live material, 11/Ft^3/AC dead material. Vol/AC factors from Manitou Experimental Forest; 23 plots on non-CFL land. The CSFS definition of non CFL-Forest land that is not capable of yielding usable wood products due to adverse site conditions, including physical inaccessibility. Land that does not meet the following qualifications; (1) either 1500 B.F. or 600 Ft^3/Ac and 40 B. A. of trees 5" DBH or larger; (2) Definite seedling-sapling stands with 40% crown closure or more. This classification includes non-CFL lands of all forest types; in Jefferson County 900 acres are pinon-juniper; in Clear Creek 1800 acres are pinon-juniper type.

(2) Spruce only
(3) Availability factor applied
(4) There is no 5 year mortality of white pine
(5) Includes 111 MCF of white pine
(6) Computed by multiplying # of stems killed each x 10.5Ft^3/stem factor
(7) Uses stem count by CSFS, 100% coverage
(8) Acres of Ponderosa pine forest type
(9) From CSFS estimates
(10) Refer to footnote (4) of Table I-1.

Table II-2 (Continued) BOULDER-LONGMONT TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON CFL-MATERIAL

	Routt N. F. Acres	Routt N. F. Mcf	Total of (10) Acres	Total of (10) MCF
5 year Mortality (Standing)				
Spruce-fir type				
Douglas-fir type				
Lodgepole pine type		1,230		
Ponderosa pine type				
Aspen type		26		
Total 5 year mortality	N/A	1,256	N/A	36,736
Sound Dead (Down)				
Spruce-fir type		N/A		
Douglas-fir type		N/A		
Lodgepole pine type		4,278		
Ponderosa pine type		N/A		
Aspen type		N/A		
Total Sound Dead	N/A	4,278	N/A	117,400
Non CFL Lands (1)				
Live	N/A	532		
Dead	N/A	10		
Total Non CFL	879	542	473,787	291,852
	# of Stems		# of Stems	
P. P. Beetle Kill Mortality				
Ponderosa pine 1977	0	0	451,000	4,736
Ponderosa Pine 1976	0	0	451,000	4,736
Total P. P. Beetle Kill Mortality	0	0	902,000	9,472

concerning cuts was available for Wyoming state and private lands. Also the same volume of timber would be generated for Boulder-Longmont using the cutting strategy described in the methodology section. This is because the Medicine Bow does not have significant amounts of the ponderosa pine forest type and no information concerning volumes and area for this forest type was available for B.L.M. state and private lands. Comparatively little of the present beetle kill infestation exists in Wyoming for ponderosa pine.

Wood Processor's Information

Information was obtained from producers of wood products at each of the two sites. The producers are listed in Table II-4. In order not to divulge any confidential information concerning the operation of an individual company, production cost, and value data from the two sites have been aggregated.

Table II-5 lists the values for each product currently produced by the piece, mbf and mcf. The conversion factors used are given in the methodology section. The current utilization capacity for the Boulder-Longmont processing area is listed in Table II-6. This table is based on the assumption that wood processors listed in Table II-4 are operating 240 days/year, 8 hours/day at maximum efficiency.

U. S. Forest Service estimates of costs of delivering raw materials to the Boulder-Longmont processing area are given in Table II-7. The data were very limited in this area. Only two USFS appraisals were available and costs were identical for each appraisal. The Boulder-Longmont wood processors were not able to supply information of cost of their various expenses. Therefore, no range is given here for highest and lowest costs.

Table II-8 and II-9 present the population and transportation facilities available. The population of Boulder is expected to remain fairly constant in the "foreseeable" future because of the "Danish Law" which limits the rate of growth. Longmont is expected to grow, although no growth information is available for either Longmont or Boulder.

The transportation characteristics are slightly above average for the Boulder-Longmont tributary area. This is because Albany County, which was below average because of a lack of accessibility in reaching the wood resource is not included, as it was in the Fort Collins-Loveland tributary area. Boulder County has an above-average transportation network and the remaining counties within the Boulder-Longmont tributary area have average transportation characteristics.

Table II-3 ANNUAL POTENTIAL YIELD & PROGRAMMED CURRENT CUT FOR BOULDER-LONGMONT TRIBUTARY AREA

	Roosevelt N.F.		Routt N.F. Sawtimber		Arapaho N. F.		State & Private		Total for(6) Table II-3	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF		
Potential yield										
Standard	14,000	5,367	3,340	545	5,542	398	Sawtimber	2,252		
Special	240	93	65	6	4,890	174	Poletimber	3,758		
Total	14,240[4]	5,460	3,405	551	10,432	572	N/A	6,010	28,077	12,593
Current cut										
Standard	2,117	1,347	385	411	292	359				
Special	820	1,500	20	16	146	101				
Total	2,938	2,847	405	427	438	460	N/A	915.5[1]	3,781	4,649
Vol from Ponderosa Pine thinnings/yr										
Sawtimber	37,477	2,249	0	0	0	0	38,720	2,323		
Poletimber	1,368	82	0	0	0	0	11,680	701		
Total	38,845[5]	2,331	0	0	0	0	50,400	3,024	89,245	5,355

(1) Includes Larimer and Boulder Counties only
(2) From previous CSU report
(3) From FY/76 programmed harvest statement, this would vary from year to year
(4) Acres to be cut over a ten-year period
(5) Acres to be thinned over a five-year period
(6) Refer to footnote (4) of Table I-1.

Table II-4. Wood Processors in the Boulder-Longmont Processing Area which make up the present utilization capacity.

Bustemonte & Sons
7859 Diagonal Highway
Longmont, CO 80501

City of Boulder
Dick Aynan, Park Ranger
50th and Pearl
Boulder, CO 80904

Bob Doherty
Sunshine Canyon
Boulder, CO 80301

Mountain Milling
Freeman & Suiszer
49th & Pearl
Boulder, CO 80302

John Sainsbury
Sugarloaf Star Route
55th & Valmont
Boulder, CO 80302

9 Firewood dealers

Table II-5. Boulder-Longmont Product Values (FOB mill)

Product	Dollars each	Dollars/MBF of finished product	Dollars/MCF of finished product
Planed boards		190-200	3474-3840
Rough boards		150	1800
Barn Poles	13.60/piece	289	3469
Corral Poles	2.37/piece	253	3038
Fence posts	1.60/post	310	3721
Houselogs (tongue & grooved)	10.88/piece	162	1944
Paneling		300	5485
Dimension lumber		200	2400
Railroad ties	5.75/piece	297	3564
Firewood	50.00/cord	49	588
Chips	10.00/ton	--	125
Shavings	10.00/ton	--	125
Sawdust	10.00/ton	--	125

Table II-6. Boulder-Longmont Existing Wood Utilization Capacity 1/

Mill Capacity mcf/year		Products
567.1		Rough boards
39.4		Planed boards
112.9		Barn poles
22.5		Corral poles
37.2		Fence posts
40.2		Houselogs
52.5		Paneling
58.6		Dimension lumber
275.4		Firewood
48.9		Railroad ties (decorative)
1254.7		
428.3	By-products:	Chips
209.2		Sawdust
55.3		Shavings
692.8		

1/ Refer to Table I-6 footnote.

Table II-7. Costs of Delivering Raw Materials to Boulder-Longmont Processing Area.[1/]

	Highest, Lowest & Average Cost
Stumpage (sawtimber)	$3.00/mbf [2/]
Stumpage (fuelwood)	1.89/ccf
Harvesting (sawtimber)	47.49/mbf
Harvesting (fuelwood)	22.19/ccf
Transportation costs to Boulder-Longmont	
Sawtimber	19.69/mbf
Fuelwood	9.97/ccf
Total Delivery Costs [3/]	
Sawtimber	92.36/mbf
Fuelwood	46.38/ccf

[1/] Taken from two 1976 USFS appraisals that sold, sales assumed to be approximately the same size in volume.

[2/] Net indicated stumpage is $-46.39 (negative).

[3/] Includes profit and risk.

Table II-8. Boulder-Longmont Population

	Boulder [1]	Longmont [2]	Boulder County [2]
1970		23,209	130,000
1976	72,500	36,000	174,000

Sources: [1] Boulder Chamber of Commerce
[2] Longmont Chamber of Commerce

Table II-9.
Boulder-Longmont Transportation Facilities

Motor Freight Carriers

-- TWX Truck Lines
Home Base: Denver

-- Globe Truck
Home Base: Denver

-- Miller Bros.
Home Base: Denver

Freight service consists of the Chicago, Burlington and Quincy Railroad and the Colorado and Southern Railroads.

Source:
Longmont Chamber of Commerce.

REFERENCES

References 1 through 14 of the Fort Collins-Loveland Study were utilized in this case study. The following were cited in addition to those references:

15. USDA Forest Service. 1974. Working Papers of Timber Management Plan. Routt National Forest. Region 2 Office, Denver, Colorado.

16. USDA Forest Service. 1975. Title 2400 Timber Management: Region 2 Supplement No. 197. Region 2 Office, Denver Colorado.

Agencies Consulted

1. Boulder County Forestry Department, Longmont, Colorado
2. CSFS. State Office. Fort Collins, Colorado.
3. CSFS. Fort Collins District. Fort Collins, Colorado.
4. CSFS. Golden District Office. Golden, Colorado.
5. CSFS. Boulder District Office. Longmont, Colorado.
6. Department of Commerce. Boulder and Longmont Colorado.
7. Larimer County, Weed and Pest Department. Fort Collins, Colorado.
8. USDA Forest Service. Araphao-Roosevelt Supervisors Office. Fort Collins, Colorado.
9. USDA Forest Service. Rocky Mountain Experiment Station, Fort Collins, Colorado.
10. USDA Forest Service, Regional Office. Denver, Colorado.
11. USDI Bureau of Land Management, State Office. Denver, Colorado.
12. USDI. Bureau of Land Management, Canon City District Office, Canon City, Colorado.

CASE STUDY III: DENVER TRIBUTARY AREA

Summary

The Denver processing site has 1,650,825 mcf of living raw material. This is the largest tributary area both in acreage and raw material volume. Most of the data were acquired from sources used in the Fort Collins-Loveland study. The appropriate adjustment factors were applied to the Fort Collins-Loveland sources to translate the information into the form needed for this case study. One additional source of information was the TMP for the Pike National Forest. This TMP was written in 1973. An accessibility factor was estimated with the aid of the Timber Management Office of the Pike-San Isabel National Forest.

The tributary boundary was formulated using information supplied by conversations with wood processors and timber management offices of the Arapaho-Roosevelt and Pike-San Isabel National Forests. This tributary area boundary, in most cases, follows county boundaries. Only Albany and Douglas Counties required area adjustment factors.

Total five-year mortality was 33,872 mcf and the total sound dead is 23,365 mcf. The annual beetle kill mortality was 4,840 mcf in 1976. At present, the potential cut for the Denver tributary area is 38,235 mcf/year -- by far the largest cut for any tributary area in the area of concern. The current annual cut is 6,513 mcf. If the ponderosa pine type was to be thinned according to strategy described in the methodology section of this report 8,903 mcf/year would be harvested.

The average value for rough cut boards in the Denver area was $145/mbf. Utility poles and houselogs are major products for the Denver processing center, poles would have an average value of $50/piece and houselogs would run about $13.60/piece. The total wood utilization capacity was 1,882.8 mcf on an annual basis. Annual by-product production would amount to 432.4 mcf. The reason that current annual cut is higher than the Denver utilization capacity, is largely due to competition from the mills in Kremmling and Eagle. These mills account for most of the current cut in Grand County, where Denver can only utilize a relatively small portion of this cut.

Cost information was limited for the Denver processing center. The appraisals available were few in number and cost information from the wood processors was variable. The average stumpage price was $4.00/mbf for sawtimber and 1.89/ccf for fuelwood. The total delivery costs which include harvesting, transportation and profit and risk are $78.21/mbf for sawtimber and $46.38/ccf for fuelwood.

Denver had a population of 1,391,000 in 1974 and has numerous transportation facilities. The tributary area has above average transportation characteristics.

Introduction

Denver is a processing center which has two very large wood treating facilities and is the largest of all the tributary areas throughout the area of concern. The tributary area is depicted on Figure III-1. Inside of this boundary are the Roosevelt National Forest and portions of the Pike, Arapaho, Medicine Bow and Routt National Forests. The boundary was drawn by using information employed in the Fort Collins-Loveland case study and conversations with wood processors in Denver. The tributary area boundaries are made along county boundaries in order to avoid inaccuracy in determining volumes using area adjustment factors.

Denver has the most extensive rail service of any processing center in the area of concern. This includes rail service from the Burlington Northern, Colorado and Southern Railway Co., Union Pacific R.R. and the Denver and Rio Grande Western R.R. The major highways are U.S. 40 and 285, and Interstate 70 and 25.

The area adjustment factors are .679 for the Arapaho National Forest, .236 for the Pike, .071 for the Routt, .17 for the Medicine Bow and .155 for Douglas County state and private lands. The accessibility factors are: .519 for the Arapaho, .50 for the Pike, .55 for the Routt and .32 for the Medicine Bow. The data for Albany County was incorporated into this study from the Fort Collins-Loveland study.

The timber inventory data available from the Pike National Forest is not as up-to-date as that from other national forests. This is because the Pike-San Isabel National Forest has not been inventoried since 1962. The 1962 TMPs were utilized in this report. Amendments (1974) to the TMPs gave information concerning potential and current annual cuts. Little information was available to formulate accessibility factors for the Pike-San Isabel National Forest. After consultation with the Pike-San Isabel timber management office an acces-

sibility factor of .50 for both the Pike and San Isabel National Forests was chosen. As development of the new TMPs progress, these accessibility factors will most likely have to be revised.

Living Raw Material

The information supplied in Table III-1 applies to all the available area within the Denver tributary area boundary. This is similar to Fort Collins-Loveland tributary with the addition of Grand County, Southern Jefferson County and the eastern portion of Douglas County. The usual procedures and the above stated adjustment factors were employed to compute the data on Table III-1.

Only the RPA computer printouts, which supplied information by forest type, were utilized in computing acres and volumes for the Arapaho National Forest. The Arapaho TMP was not utilized. The TMP has information available by forest district. This TMP was not utilized because it would require a myriad of adjustment factors to get the data into the format needed in this case study. This would probably greatly affect the accuracy of the TMP data. The area adjustment for the Routt National Forest is larger than the Fort Collins-Loveland area adjustment factor concerning the Routt. Therefore, more material is included in this tributary than the Fort Collins-Loveland study. Similarly, more material is available for Jefferson County simply because all of the forested area of Jefferson County is included where only the northern portion was used in the Fort Collins-Loveland study.

Portions of the Pike National Forest are included in this tributary area. The Pike resides in the southern portion of Clear Creek and Jefferson Counties and the eastern portion of Douglas County. The data for the Pike were taken from the 1962 TMP. The new inventory will not be completed until 1979. Little land use data were available. Therefore, it was necessary to estimate the amount of accessible material. The resulting accessibility factor is .5. As new inventory data becomes available information concerning the Pike and San Isabel National Forests should greatly improve. The Pike and San Isabel National Forests include data for the white pine forest type.

The appropriate area adjustment factor was applied to the Douglas County, state and private lands. Grand County, state and private lands are included in

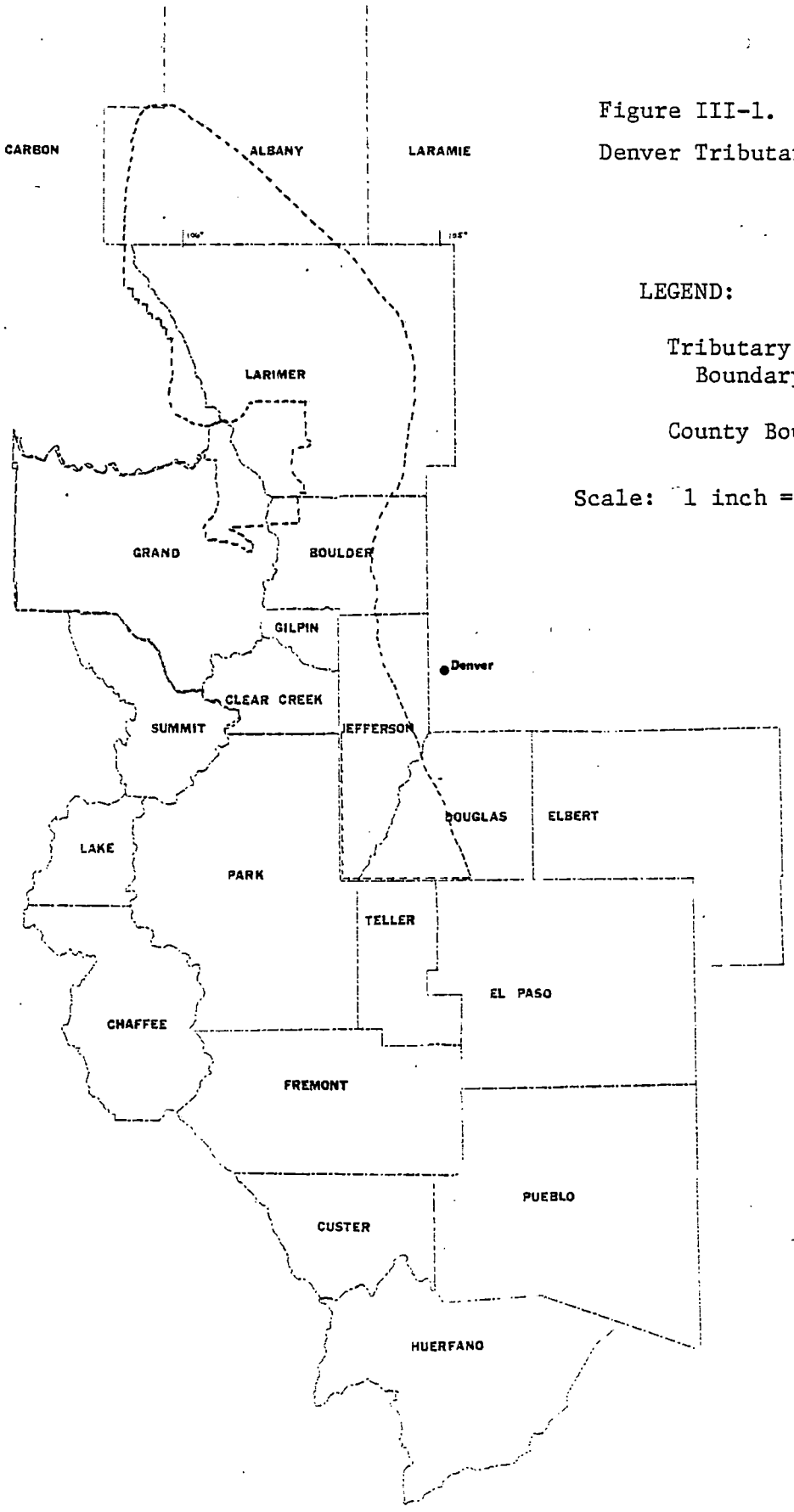

Figure III-1.
Denver Tributary Area

LEGEND:

Tributary Area Boundary — — — —

County Boundary— - — -

Scale: 1 inch = 34 miles

this case study. No information for BLM lands was available. In Grand County BLM lands may be of significance because of the high quality forest land which the BLM manages. Other than the above stated exceptions this case study follows the same format and procedure as the Fort Collins-Loveland study.

Dead Raw Material

The data acquired for dead raw material are presented in Table III-2. New sources of data for this table were very limited. Accurate information was acquired for the Roosevelt and Arapaho National Forests. However, the Pike National Forest did not have dead volumes available. The usual volume per acre factors were applied where no other soruces of information were available. The non-CFL information is presented using TMPs and TRIs as sources.

The ponderosa pine beetle kill mortality is computed in the same manner as the previous two case studies. The same build-up ratio and volumes per stem still apply.

Potential Yield and Programmed Current Cut

This information is presented in Table III-3. Again, it approximates the Fort Collins-Loveland tables. The appropriate area adjustment factors were applied which cause the Routt and Arapaho National Forests potential and current cuts to be larger than in the Fort Collins-Loveland study. More recent data were available for the Pike National Forest concerning potential yields and the current cuts. This new information was available from 1974 amendments to the TMP. The methodology used to compute the potential volume from ponderosa pine thinnings is the same as reported earlier in this report.

Wood Processor's Information

Table III-4, 5 and 6 present information concerning what processors were contacted and their current product values and capacities. Denver was an unusual processing center because it has two large wood treating facilities which use wood raw materials from outside of Colorado. The capacities given are for utilization of Colorado raw materials only. With that exception, no new or unusual assumptions ere made for Table II-4 through 6.

Table III-7 presents the cost data. Two current USFS appraisals were acquired and compared to information supplied by the wood processors. The appraisals were within the range of figures supplied by the processors. There was considerable variability in costs for this processing area.

Table III-8 and III-9 list the Denver population and transportation facilities available. Denver has the largest population and the most extensive transportation facilities of any of the processing centers in the area of concern. The transportation network for the entire tributary area is above average. Albany County has a below average transportation network; Boulder and Douglas Counties have a good transportation network; the remaining counties have an average or slightly above average transportation network.

Table III-1

DENVER TRIBUTARY AREA LIVE CFL LAND

	Boulder County TRI #14		Gilpin County TRI #14		Clear Creek Co. TRI #14		Larimer County TRI #1		Jefferson County TRI #15		Douglas Co. TRI #19		Albany Co.Wyo Int-Survey		Grand County TRI #5	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF			Acres	MCF
Sawtimber																
Spruce-fir type	5,700	18,285	2,100	7,850	5,400	14,412	N/A	N/A	0	0	0	0	N/A	N/A	3,400	9,496
Douglas-fir type	2,800	3,046	1,400	597	3,500	2,840	6,900	4,444	13,500	11,953	465	392	N/A	N/A	0	0
Lodgepole pine type	2,900	5,808	0	0	1,700	2,267	3,400	3,995	0	0	0	0	N/A	N/A	6,700	10,608
Ponderosa pine type	13,500	12,473	2,100	1,931	3,500	2,597	8,700	7,491	36,400	34,101	2,483	2,170	N/A	N/A	0	0
Aspen type	0	0	0	0	0	0	N/A	N/A	0	0	0	0	N/A	N/A	0	0
Total Sawtimber	24,900	39,612	5,600	10,378	14,100	22,116	19,000	15,930	49,900	46,054	2,948	2,562	32,500	38,596	10,100	20,104
Poletimber																
Spruce-fir type	1,000	2,465	2,800	4,608	4,400	8,208	N/A	N/A	1,700	4,385	0	0	N/A	N/A	6,700	8,532
Douglas-fir type	6,700	5,799	2,100	1,748	5,200	5,859	15,600	10,046	28,700	29,620	1,179	914	N/A	N/A	0	0
Lodgepole pine type	13,400	16,355	16,300	19,794	14,200	19,755	26,100	30,667	18,600	22,201	0	0	N/A	N/A	50,500	71,071
Ponderosa pine type	21,000	19,140	N/A	N/A	900	938	19,000	16,359	19,400	20,006	1,536	1,348	N/A	N/A	0	
Aspen type	1,700	2,362	1,100	1,014	2,300	3,464	N/A	N/A	850	1,573	0	0	N/A	N/A	8,400	10,200
Total Poletimber	43,800	46,121	22,300	27,164	27,000	38,224	60,700	57,072	69,250	77,785	2,715	2,262	16,000	24,931	65,600	89,803
Seedlings and Saplings																
Spruce-fir type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	N/A		N/A	N/A
Douglas-fir type	N/A	N/A	N/A	N/A	N/A	N/A	1,700	1,095	N/A	N/A	N/A	N/A	N/A		0	0
Lodgepole pine type	N/A	N/A	2,100	345	1,600	173	10,400	12,220	5,100	467	0	0	N/A		6,700	3,492
Ponderosa pine type	N/A	N/A	N/A	N/A	N/A	N/A	3,500	3,014	N/A	N/A	N/A	N/A	N/A		0	0
Aspen type	2,200	976	1,900	427	700	34	N/A	N/A	850	195	0	0	N/A		N/A	N/A
Total Seedlings & Saplings	2,200	976	4,000	772	2,300	207	15,600	16,329	5,950	662	N/A	N/A	2,500	N/A	8,400	3,492
Rough°																
Softwood																
Hardwood																
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rotten																
Softwood																
Hardwood																
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table III-1 (Continued

DENVER TRIBUTARY AREA LIVE CFL Land

	Colo St. For TRI #8		Roosevelt N.F. 1975 Timber Inv.		Roosevelt N.F. By Species from 1979 RPA		Medicine Bow 1973 TMP		Arapaho N.F. By Forest type 1979 RPA		Pike N.F.		Routt N. F. 1973 TMP		Total for Table III-1 (10)	
Sawtimber[1]	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Spruce-fir	3,200	32,040	25,281	69,612		60,673	17,174	N/A	N/A	197,086	16,992	36,826	7,101	13,663		
Douglas-fir	0	0	16,513	14,948		13,223	0	N/A	0	0	19,588	15,810	335	288		
Lodgepole pine	3,200	15,834	35,318	82,380		71,770	22,657	N/A	N/A	156,424	3,776	8,598	4,789	9,906		
Ponderosa pine type	0	0	37,477	21,517		20,568	0	N/A	0	0	27,612	22,280	0	0		
Aspen type	0	0	0	0		5,237	0	N/A	N/A[9]	8,758[5]	118[6]	129	3,204	3,487		
Total Sawtimber	6,400	47,874	114,589	188,457	N/A	171,471	39,831	43,610	178,318	362,268	68,821	83,643	15,429	27,344	581,701	948,548
Poletimber[1]																
Spruce-fir	7,300	8,443	3,830	6,398		16,992	3,017	N/A	N/A	6,013	2,714	2,316	1,540	1,851		
Douglas-fir	0	0	7,436	6,188		9,233	0	N/A	0	0	5,545	6,548	0	0		
Lodgepole pine	26,700	60,824	49,625	69,049		76,851	8,898	N/A	N/A	42,249	5,664	6,562	1,953	3,471		
Ponderosa pine	0	0	5,473	3,070		3,746	0	N/A	0	0	2,360	847	0	0		
Aspen	7,500	17,173	4,881	5,565		3,230	0	N/A	N/A[9]	10,118	7,198[7]	7,839	3,024	3,050		
Total Poletimber	41,500	86,440	71,245	90,270	N/A	110,052	11,915	10,550	27,929	58,380	27,021	24,112	6,517	8,372	493,492	641,977
Seedling Saplings[1]																
Spruce-fir			947	118			4,068	N/A	N/A	10,056	0	0	3,431	793		
Douglas fir			0	0			0	N/A	0	0	354	N/A	0	0		
Lodgepole pine			8,974	1,845			2,202	N/A	N/A	3,560	118	N/A	526	257		
Ponderosa pine			0	0			0	N/A	0	0	472	N/A	0	0		
Aspen			532	0			0	N/A	N/A[9]	2,111	1,062[8]	N/A	1,825	424		
Total Seedling & Saplings	N/A	N/A	10,453	1,963	N/A	N/A	6,270	2,550	8,593	15,727	2,124	N/A	5,782	1,474	74,172	44,152
Rough																
Softwood				2,267				1,600						533		
Hardwood				39				0						211		
Total Rough	N/A	N/A	N/A	2,306	N/A	N/A	N/A	1,600	N/A	N/A	N/A	N/A	N/A	744		4,650
Rotten																
Softwood				8,618				900						567		
Hardwood				586				0						827		
Total Rotten	N/A	N/A	N/A	9,204	N/A	N/A	N/A	900	N/A	N/A	N/A	N/A	N/A	1,394		11,498

1) By Forest type unless otherwise noted
2) From Arapaho 1969 Timber Inventory
3) Englemann Spruce only
4) Area & Availability factor applied (.0139)
5) Includes 735 MCF of white pine type
6) Includes 3540 acres of white pine type, MCF not available
7) Includes 2006 acres of white pine type, MCF not available
8) Includes 118 acres of white pine type, MCF not available
9) Total average of Sawtimbe, poletimber and seedlings & sapling is 218,480 acres 83% of it is assumed Sawtimber, 13% Poletimber 4% Seedlings/saplings. Percentages are arrived at by totaling volumes per size class and applying a percentage of each size class of the total volume to the total acreage
(10) Refer to footnote (4) of Table I-1.

Table III-2

DENVER TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL

	Boulder Co.		Gilpin Co.		Clear Creek Co.		Larimer Co.		Jefferson Co.		Douglas Co.		Grand Co.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 year Mortality (standing)														
Spruce-fir type		5,567		4,071		8,142				1,423	0	0	N/A	8,393
Douglas-fir type		N/A		N/A		N/A				N/A	N/A	N/A	0	0
Lodgepole pine type		N/A		N/A		N/A				N/A	0	0	N/A	N/A
Ponderosa pine type		N/A		N/A		N/A				N/A	N/A	N/A	0	0
Aspen type		N/A		N/A		N/A				N/A	0	0	N/A	N/A
Total 5 year Mortality	N/A	5,567	N/A	4,071	N/A	8,142	N/A	N/A	N/A	1,423	N/A	N/A	N/A	8,393
Sound Dead (Down)														
Spruce-fir type		N/A		N/A		N/A		N/A		N/A	0	0	N/A	52,718
Douglas-fir type		N/A		N/A		N/A		N/A		N/A	N/A	N/A	0	0
Lodgepole pine type		13,448		13,448		13,118		24,338		15,345	0	0	N/A	N/A
Ponderosa pine type		N/A		N/A		N/A		N/A		N/A	N/A	N/A	0	0
Aspen type		N/A		N/A		N/A		N/A		N/A	0	0	N/A	N/A
Total Sound Dead	N/A	13,448	N/A	13,448	N.A	13,118	N/A	24,338	N/A	15,345	N/A	N/A	N/A	52,718
Non CFL Lands[1]														
Live	N/A	17,303	N/A	3,509	N/A	6,231	N/A	94,198	N/A	26,559	N/A	5,505	N/A	5,082
Dead	N/A	314	N/A	64	N/A	113	N/A	1,713	N/A	483	N/A	100	N/A	92
Total Non CFL	28,600	17,617	5,800	3,573	10,300	6,344	155,700	95,911	43,900	27,042	9,100	5,605	8,400	5,174
	# of Stems		# of Stems		# of Stems		# of Stems		# of Stems		# of Stems			
P. P. Beetle Kill Mortality[6]														
Ponderosa pine 1977	116,400	1222.[7]	1,800	19	7,200	76	74,500	782	98,000	1,029	4,000	42	0	0
Ponderosa Pine 1976	116,400	1222.	1,800	19	7,200	76	74,500	782	98,000	1,029	4,000	42	0	0
Total Ponderosa Pine Mortality	232,800	2444.	3,600	38	14,400	152	149,000	1,564	196,000	2,058	8,000	84	0	0

Non CFL conifers in counties assumed to be 605/Ft^3/Ac live material, 11/Ft^3/Ac dead material. Vol/Ac factors from Manitou Experimental Forest; 23 plots on Non-CFL land. The CSFS definition of non CFL-forest land that is not capable of yielding usable wood products due to adverse site conditions, including physical inaccessibility. Land that does not meet the following qualifications: (1) Either 1500 B.F. or 600 Ft^3/Ac and 40 B. A. of trees 5" dbh or larger; (2) definite seedling-sapling stands with 40% crown coverage or more. This classification includes non-CFL lands of all forest types; in Jefferson County 900 acres are pinon-juniper in Clear Creek 1800 acres are pinon-juniper type.

2) Spruce Only
3) Availability factor applied
4) From previous CSU reports
4) Area adjustment factor applied
5) Plus 25 MCF of white pine
6) Computed by multiplying # of stems killed each year x 10.5 Ft^3/stem factor
7) U.S.F.S. - stem count by CSFS, 100% coverage
8) Acres of ponderosa pine forest type
9) From CSFS estimates

Table III-2 (Continued) DENVER TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL

	Roosevelt N.F. 1979, R.P.A.		Arapaho N.F.[10] Timber Inventory		Pike N. F.		State Forest		Medicine Bow		Total for Table III-2[12]	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 Year Mortality (Stand)												
Spruce-Fir type		245		10,266		16,376		33,641				
Douglas-Fir type		912		0		N/A		N/A				
Lodgepole pine type		1,593		3,568		N/A		N/A		4,550		
Ponderosa pine type		3,301		0		N/A		N/A				
Aspen type		46		174		N/A		N/A		0		
Total 5 Year Mortality	N/A	6,097	N/A	14,008	N/A	16,376	N/A	33,641		4,550	N/A	102,268
Sound Dead (Down)												
Spruce-Fir type		2,804[2]		14,157		N/A		N/A		N/A		
Douglas-Fir type		205		0		N/A		N/A		N/A		
Lodgepole pine type		9,951		12,506		7,788		24,667		13,786		
Ponderosa pine type		1,357		0		N/A		N/A		N/A		
Aspen type		472		188		N/A		N/A		N/A		
Total Sound Dead	N/A	14,789	N/A	27,481	N/A[11]	7,788	N/A	24,667		13,786	N/A	220,925
Non CFL Lands[1]												
Live	N/A	95,469	N/A	63,513	N/A	10,897	N/A	1,936	N/A	7,425		337,627
Dead	N/A	1,736	N/A	1,155	N/A	198	N/A	35	N/A	135		6,712
Total Non CFL	157,800	97,205	104,980	64,668	18,011	11,095	3,200	1,971	12,272	7,560	558,063	344,339
	# of stems		# of stems		# of stems						# of stems	
P. P. Beetle Kill Mortality												
Ponderosa pine 1977	152,300	1,599	800	8.	6,000	63	0	0	0	0	461,000	4,840
Ponderosa pine 1976	152,300	1,599	800	8.	6,000	63	0	0	0	0	461,000	4,840
Total Ponderosa pine Mortality	304,600	3,198	1,600	16.	12,000	126	0	0	0	0	922,000	9,680

Non CFL conifers in counties, assumed to be 605/Ft^3/Ac live material, 11/Ft^3/Ac dead material. Vol/Ac factors from Manitou Exper. Forest; 23 plots on non-CFL land. The CSFS definition of Non CFL-forest land that is not capable of yielding usuable wood products due to adverse site conditions, including physical inaccessibility. Land that does not meet the following qualifications: (1) Either 1500 B.F. or 600 Ft^3/Ac and 40 B.A. of trees 5" D.B.H. or larger (2) Definite seedling-Sapling stands with 40% crown cover or more. This classification includes non-CFL lands of all forest types; in Jefferson County 900 acres are pinon-juniper; in Clear Creek 1800 acres are pinon-juniper.

10) From previous CSU report includes only Clear Creek Ranger District
11) Includes 630 MCF of white pine sound dead
12) Refer to footnote (4) of Table I-1.

Table III- 3

ANNUAL POTENTIAL YIELD AND PROGRAMMED CURRENT CUT FOR DENVER TRIBUTARY AREA

	Roosevelt N.F. 1975 T.M.P.		Routt N.F. Sawtimber		Arapaho N. F. 1975 T.M.P.		Medicine Bow N.F. Sawtimber		Pike N.F.		State & Private		Total for Table III- 3	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Potential Yield														
Standard	14,000	5,367	4,390	7,163	21,932	1,578	11,254	13,576	N/A	244	Sawtimber	3,156		
Special	240	93	85	82	1,935	732	510	337	N/A	275	Poletimber	5,632		
Total	14,240	5,460	4,475	7,245	23,867	2,310	11,764	13,913	N/A	519	N/A	8,788	54,346	38,235 [1]
Current Cut														
Standard	2,117	1,347	506	540	1,154	1,419	782	932		N/A				
Special	820	1,500	26	21	577	402	170	144		N/A				
Total	2,938	2,847	532	561	1,731	1,819	952	1,076	N/A	210	N/A	N/A	6,153	6,513
Potential Vol from Ponderosa Pine Thinnings/Yr														
Sawtimber	37,477	2,249	0	0	0	0	0	0	27,612	1,657	65,891	3,953		
Poletimber	1,368	82	0	0	0	0	0	0	590	35	15,459	927		
Total	38,845	2,331	0	0	0	0	0	0	28,202	1,692	81,350	4,880	148,397	8,903

1) Colorado state & private lands only.

Table III-4. Wood Processors in the Denver Area which make up the Present Utilization Capacity.

Koopers Co., Inc.
West 56th Avenue & Fox
Denver 80216

Colorado Log Homes
1925 West Dartmouth
Englewood 80110

Broderick Wood Products
58006 Alapago Street
Denver 80216

Reed Mill and Lumber Co.
4510 Wynkoop
Denver 80237

Rocky Mountain Forest Products
765 S. Garfield
Denver 80216

Western Heritage Log Co.
Suite 220
3515 S. Tamarac Drive
Denver 80237

Bob Wutzke
Raidroad Ties Co.
Denver 80237

20 Firewood dealers

Table III-5. Denver Product Values

Product	Dollars Each	Dollars/MBF of finished product	Dollars/MCF of finished product
Pallets	5.00/pallet	250	3000
Timbers (treated)	5.20/piece	284	3408
Rough boards		145	1740
Planed boards		200-210	3657 - 3840
Utility Poles	50.00/piece	997	11964
Houselogs (tongue & grooved, planed)	13.60/piece	203	2437
Barn poles	14.00/piece	297	3564
Corral poles	2.50/piece	240	2880
Fence posts	1.75/piece	339	4069
Fencing		270	3240
Railroad ties	5.50/piece	284	3410
Beams		220-240	4022 - 4388
Firewood	65.00/cord	64	768
Chips	10.00/ton		125
Shavings	10.00/ton		125
Sawdust	10.00/ton		125

Table III-6. Denver Existing Wood Utilization Capacity[1/]

Mill Capacity mcf/year	Products
97.8	Pallets
48.9	Timbers
87.9	Rough boards
78.7	Planed boards
95.5	Utility poles
334.8	Houselogs
178.7	Barn poles
9.4	Corral poles
123.8	Fence posts
29.3	Fencing
612.0	Firewood
146.6	Railroad ties (decorative)
39.4	Beams
1882.8	
	By-products:
206.4	Chips
100.8	Sawdust
125.2	Shavings
432.4	

1/ Refer to Table I-6 footnote.

Table III-7. Costs of Delivering Raw Materials to Denver Processing Center[1/]

	Lowest Cost	Average Cost	Highest Cost
Stumpage (sawtimber)	$2.00/mbf [2/]	$4.00/mbf	$6.00/mbf[3/]
Stumpage (fuelwood)	1.89/ccf	1.89/ccf	1.89/ccf
Harvesting (sawtimber)	38.84/mbf	43.17/mbf	47.49/mbf
Harvesting (fuelwood)	22.19/ccf	22.19/ccf	22.19/ccf
Transportation Costs to Denver			
Sawtimber	7.55/mbf	13.62/mbf	47.49/mbf
Fuelwood	9.97/ccf	9.97/ccf	9.97/ccf
Total Delivery Costs[4/]			
Sawtimber	64.06/mbf	78.21/mbf	92.36/mbf
Fuelwood	46.38/ccf	46.38/ccf	46.38/ccf

1/ From two 1975-76 USFS appraisals that sold, sales assumed to be approximately the same size in volume.

2/ Net indicated stumpage is $-46.39 (negative).

3/ Net indicated stumpage is $-1.33 (negative).

4/ Includes profit and risk.

Table III-8. Denver Population.

Denver Metro Area	1970	1,229,798
	1974	1,391,000

Source: Denver Chamber of Commerce, standard metropolitan statistical area.

Table III-9. Denver Transportation Facilities

IML Freight, Inc.
2100 - 31st Street
Denver 80216

Time-DC Inc.
P.O. Box 2550
Lubbock, TX 79408

TWX Truck Lines
Denver

Globe Truck
Denver

Ringsby United
5773 S. Prince
Littleton

Weicker Transfer & Storage
P.O. Box 5207
Denver 80217

Miller Bros.
Denver

Rio Grande Motorway, Inc.
P.O. Box 5628
Denver 80217

Truck tonnage in and out of Denver was 1,023,405 tons/month for 1976.

Freight Service

Burlington Northern
3010 W. 16th, Suite 207
Denver 80202

Denver & Rio Grande Western R.R.
P.O. Box 5482
Denver

Colorado & Southern Railway
1405 Curtis, Suite 2000
Denver 80202

Union Pacific Railroad
1735 - 19th St.
Denver 80207

Source: Denver Chamber of Commerce.

REFERENCES

References 1 through 18 of the Fort Collins-Loveland Study were utilized in this case study.

Agencies Consulted

1. Boulder County Forestry Department, Longmont, Colorado
2. CSFS. State Office. Fort Collins, Colorado.
3. CSFS. Fort Collins District. Fort Collins, Colorado.
4. CSFS. Golden District Office. Golden, Colorado.
5. CSFS. Boulder District Office. Longmont, Colorado.
6. Department of Commerce. Denver, Colorado.
7. Larimer County, Weed and Pest Department. Fort Collins, Colorado.
8. USDA Forest Service. Araphao-Roosevelt Supervisors Office. Fort Collins, Colorado.
9. USDA Forest Service. Rocky Mountain Experiment Station, Fort Collins, Colorado.
10. USDA Forest Service, Regional Office. Denver, Colorado.
11. USDI Bureau of Land Management, State Office. Denver, Colorado.
12. USDI. Bureau of Land Management, Canon City District Office, Canon City, Colorado.

CASE STUDY IV: PINE-BAILEY TRIBUTARY AREA

Summary

The Pine-Bailey processing area has 278,380 mcf of living raw material. This is the smallest tributary area in the area of concern. However, it does include an intensive beetle outbreak. Since most of the tributary includes the Pike National Forest which has not been inventoried since 1962, the data is not as accurate as would be desirable.

The tributary boundary was determined with the aid of information supplied by the South Platte Ranger District of the Pike National Forest and the timber management office of the Pike-San Isabel National Forest. Also the wood processors of Pine and Bailey were consulted.

The total five-year mortality was 33,872 mbf. The total sound dead was 23,365 mcf. The annual beetle kill mortality was 1,476 mcf in 1976. For the acreage in this tributary area this represents a considerable percentage of the growing stock. The potential yield from thinnings in ponderosa pine, using the method described earlier, is 4,604 mcf/year. The reason for this comparatively large volume is discussed later in the narrative of this case study.

The average value of rough cut boards in this processing area was $150/mbf. A major product produced was paneling, valued at $300/mbf. At present wood utilization capacity is 582,2 mcf/year. If this production was maintained 340.2 mcf/year of by-products would be produced.

Cost information was obtained from three 1975 USFS appraisals. The range of values in the data were considerable. The average stumpage price was $9.29/mbf. The total delivery cost of the wood raw material to the processing area averages $73.69/mbf. This figure includes harvesting, transportation and a margin for profit and risk.

The population of the Pine-Bailey area is 425. There are no freight facilities within the processing area and the transportation characteristics of the tributary area are below average.

Introduction

The Pine-Bailey tributary area is the smallest tributary area within the Front Range. Comparatively few mills are presently operating and they have a small production capacity. The tributary area is comparatively small because of the present small scale operation of the wood industry in the Pine-Bailey

Processing Center; it is not likely that the tributary area would extend beyond the boundary depicted on Figure IV-1. At present the hauling distance is 5 to 12 miles. This processing center was selected as a case study because it is close to the intensive mountain pine beetle infestations in Park, Jefferson, and Douglas Counties. The major highway is U.S. 285. No rail facilities exist.

This case study utilizes data from the 1963 Pike TMP, the Arapaho TMP and 1979 R.P.A. computer printouts. The state and private data were acquired from the TRIs for Douglas, Park and Jefferson Counties. The appropriate adjustment factors were applied. The area adjustment factors are .371 for the Pike National Forest and 0.24 for the Arapaho TMP, which included only the Clear Creek Ranger district. In the case of the Arapaho 1979 R.P.A. computer printouts, the area adjustment factor was .0043. Park County had an area adjustment factor of .302 and Jefferson County's was .598. Douglas County area adjustment was .155, just as in the Denver case study. The accessibility factor is .5 for the Pike National Forest and .519 for the Arapaho National Forest.

Living Raw Material

With such a comparatively small area to be covered in this case study the determination of raw material volumes was relatively simple. The data that was acquired in Fort Collins-Loveland case study for the Clear Creek Ranger District of the Arapaho NF was adjusted for this study. As stated in the previous study, the data for the Pike National Forest is not as recent and accurate as the national forests in the northern portion of the Front Range. No information was available for rough or rotten living material. This study employs the same procedures and assumptions made in the methodology section and in earlier case studies.

Dead Raw Material

Very little information concerning dead material was available for this and the following case studies. Data were acquired directly from the Arapaho National Forest from the 1970 RPA computer printouts. As before adjustment factors were also applied. The remaining lands were subject to the appropriate volume per acre factors to arrive at available five-year and sound dead material.

Most of the non-CFL land in the Pine-Bailey tributary is probably composed of ponderosa pine. This is assumed because the predominent forest type for the tributary area CFL land is ponderosa pine. The assumption of a 1:1 build-up ratio and a 10.5 cu.ft./stem still apply in computing the beetle killed mortality for this tributary area.

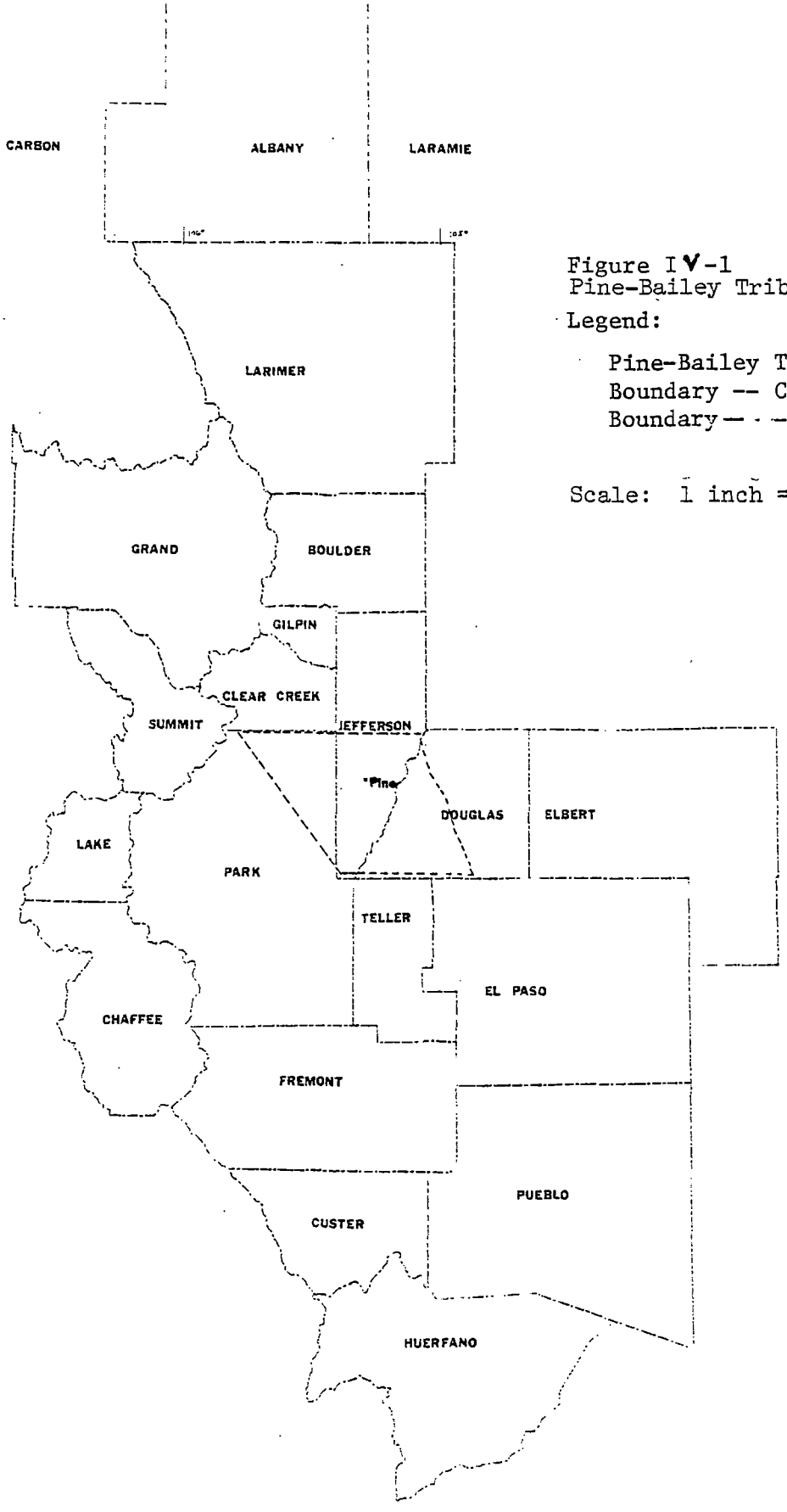

Figure IV-1
Pine-Bailey Tributary Area

Legend:

Pine-Bailey Tributary Boundary -- County Boundary — · — · —

Scale: 1 inch = 34 miles

Table IV-1

PINE-BAILEY TRIBUTARY AREA LIVE CFL LAND

	Jefferson Co. TRI #15		Park Co. TRI #16		Douglas TRI #19		Pike N.F.		Arapaho N. F. 1975 TMP (CCRO)		Arapahoe N.F. By Forest Type 1979 RPA		Total of Table IV-1 3/	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber														
Spruce-fir type	0	0	2,416	5,597	0	0	26,500	57,891	150	469		1,246		
Douglas-fir type	8,079	7,153	544	441	465	392	31,000	24,846	N/A	N/A		0		
Lodgepole pine type	0	0	0	0	0	0	6,000	13,516	57	144		988		
Ponderosa pine type	21,785	20,409	2,690	1,691	2,483	2,170	43,500	35,025	0	0		0		
Aspen type	0	0	0	0	0	0	200	202	N/A	N/A		55 2)		
Total Sawtimber	29,864	27,562	5,650	7,729	2,948	2,562	107,200	131,480	207	603	N/A	2,298	145,869	171,631
Poletimber														
Spruce-fir type	1,018	2,625	6,221	11,066	0	0	4,500	3,641	2	3		38		
Douglas-fir type	17,176	17,727	3,111	2,583	1,179	914	8,500	8,803	N/A	N/A		0		
Lodgepole pine type	11,132	13,287	1,903	2,883	0	0	9,000	10,316	21	43		267		
Ponderosa pine type	11,611	11,973	3,242	3,060	1,536	1,348	3,500	1,331	0	0		0		
Aspen type	508	941	1,117	978	0	0	11,500	12,323	N/A 1)	N/A 1)		63		
Total Poletimber	41,445	46,553	15,594	20,570	2,715	2,262	37,000	36,414	23	46	N/A	368	96,777	106,167
Seedlings-Sapling														
Spruce-fir type	N/A	N/A	151	22			0	0	7			64		
Douglas-fir type	N/A	N/A	N/A	N/A			500	N/A	N/A			6		
Lodgepole pine type	3,052	279	272	N/A			200	N/A	7			23		
Ponderosa pine type	N/A	N/A	N/A	N/A			500	N/A	N/A			0		
Aspen type	508	116	846	65			1,500	N/A	N/A			13		
Total Seedlings-saplings	3,560	395	1,269	87	N/A	N/A	2,700	N/A	14	N/A	N/A	100	7,529	582

1) From Arapaho 1969 Timber Inventory
2) Includes 9 MCF of white pine sawtimber
3) Refer to footnote (4) of Table I-1.

Table IV-2 PINE-BAILEY TRIBUTARY AREA; DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON CFL MATERIAL

	Jefferson Co.		Park Co.		Douglas Co.		Pike N.F.		Arapaho N. F. 1979 RPA (1)		Total For 3/ Table IV-2	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 year Mortality (Standing)												
Spruce-fir type		846		7,177	0	0		25,761		65(2)		
Douglas-fir type		N/A		N/A	N/A	N/A		N/A		0		
Lodgepole pine type		N/A		N/A	N/A	N/A		N/A		22		
Ponderosa pine type		N/A		N/A	N/A	N/A		N/A		0		
Aspen type		N/A		N/A	N/A	N/A		N/A		1		
Total 5 year Mortality	N/A	846	N/A	7,177	N/A	N/A	N/A	25,761	N/A	88	N/A	33,872
Sound Dead (Down)												
Spruce-fir type		N/A		N/A	N/A	N/A		N/A		89		
Douglas-fir type		N/A		N/A	N/A	N/A		N/A		0		
Lodgepole pine		9,251		1,570	0	0		12,375		79		
Ponderosa pine type		N/A		N/A	N/A	N/A		N/A		0		
Aspen type		N/A		N/A	N/A	N/A		N/A		1		
Total Sound Dead	N/A	9,251	N/A	1,570	N/A	N/A	N/A	12,375	N/A	169	N/A	23,365
Non CFL Lands												
Live	N/A	15,895	N/A	10,359	N/A	853	N/A	17,130	N/A	480	N/A	44,717
Dead	N/A	289	N/A	188	N/A	15	N/A	311	N/A	9	N/A	812
Total Non-CFL	26,273	16,184	17,123	10,547	1,411	868	28,314	17,441	794	489	73,915	45,529
	# of stems		# of stems		# of stems		# of stems		# of stems		# of stems	
P. P. Beetle Kill Mortality												
Ponderosa pine 1977	58,604	615	815	9	620	6	10,304	108	0	0	70,343	738
Ponderosa pine 1976	58,604	615	815	9	620	6	10,304	108	0	0	70,343	738
Total Beetle Kill Mortality	117,208	1,230	1,630	18	1,240	12	20,608	216	0	0	140,686	1,476

1) Plus 8 MCF white pine sound dead
2) 5 yr. mortality is by species, spruce-fir is composed of Engelmann spruce andsubalpine fir. Sound dead is reported by forest type
3) Refer to footnote (4) of Table I-1.

Table IV-3 ANNUAL POTENTIAL YIELD AND PROGRAMMED CURRENT CUT FOR PINE-BAILEY TRIBUTARY AREA

	Arapaho N.F. 1975 TMP		Pike N.F.		State & Priv.		Total for Table IV-3 (1)	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Potential yield								
Standard	119	12		383	Sawtimber 422			
Special	172	19		433	Poletimber 589			
Total	291	31	N/A	816	N/A	1,001	291	1,848
Current Cut								
Standard	4	4		N/A				
Special	0	0		N/A				
Total	4	4	N/A	329	N/A	N/A	N/A	333
Potential Vol From Ponderosa Pine Thinnings/Yr.								
Sawtimber	0	0	43,500	2,610	26,958	1,617	70,458	4,227
Poletimber	0	0	875	131	4,097	246	4,972	377
Total	0	0	44,375	2,741	31,055	1,863	75,430	4,604

(1) Refer to footnote (4) of Table I-1.

Potential Yield and Programmed Current Cut

The Pine-Bailey tributary has a potential volume from ponderosa pine thinnings which greatly exceed the potential sawtimber yield from state, private and Forest Service lands. This could be due to the relatively low potential yields dictated by the Pike-San Isabel TMPs. If marginal lands were included potential yields cited would about double for both the Pike and San Isabel National Forests throughout this report. No new assumptions or procedures were utilized in completing this portion of the case study.

Wood Processor's Information

Tables IV-4 through 6 indicate the wood processors that make up the current utilization capacity and their present product values. The mills in this area are few and unsophisticated from a technical standpoint. However, beetle kill material is being used extensively to produce paneling. The paneling is being planed and sold emphasizing the blue stain characteristics. Many of the operators in this area are making an extra effort to obtain beetle kill material to produce such decorative products. Because this processing area is so close to much of the intensive beetle infestations, perhaps increased utilization of beetle kill material at this processing center is possible.

The cost information available is presented in Table IV-7. The mills in the Pine-Bailey Processing Center have very crude accounting systems and once again the USFS appraisals were relied upon for cost estimates. The cost data varies widely. However, this probably accurately reflects the existing situation. Table IV-7 presents the costs of delivering the raw material to the Pine-Bailey Processing Area.

The population of Pine is 250 and Bailey is 175. This is the smallest population of any of the processing centers and could present a problem to wood industry expansion from a labor supply standpoint. There are no rail or freight facilities in Pine or Bailey. The transportation network for Pine-Bailey tributary is below average. This is because of the lack of railroads and major highways. The road system is slightly below average for Park County. Jefferson County is average and the included portion of Douglas County is above average.

Table IV-4 Wood Processors in the Pine-Bailey Processing Area which make up the present utilization capacity.

John Gosege Lumber
Route 2, Box 291
Pine 80470

George Overholt
Wellington Lake
828-5958

Mountain Lumber Mill
Alan Eos
Post Office Box 187
Bailey, Co 80421

Pine Valley Lumber
John Chivers, Manager
Box 171
Pine, CO. 80470

Table IV-5. Pine-Bailey Product Values (FOB mill)

Product	Dollars Each	Dollars/mbf of finished product	Dollars/mcf of finished product
Pallets	5.00/pallet	250	3000
Timbers (untreated)		160	1920
Rough boards		150	1800
Planed boards		190-210	3474-3657
Barn poles	13.40/piece	284	3408
Fence posts	1.75/piece	339	4069
Houselogs (not tongue & grooved)	9.60/piece	143	1720
Paneling		300	5485
Dimension lumber		200	2400
Beams		200-220	3657-4022
Firewood	50.00/cord	49	588
Chips	.75/yard		28
Shavings	.75/yard		28
Sawdust	.75/yard		28

Table IV-6. Pine-Bailey Existing Wood Utilization Capacity [1/]

Mill Capacity mcf/year		Products
19.5		Pallets
24.4		Timbers
24.4		Rough boards
39.4		Planed boards
94.1		Barn poles
51.6		Fence posts
66.9		Houselogs
98.4		Paneling
58.6		Dimension lumber
91.8		Firewood
13.1		Beams
582.2		
185.8	By-products:	Chips
90.7		Sawdust
63.7		Shavings
340.2		

(1) Refer to footnote of Table I-6.

Table IV-7. Costs of Delivering Raw Materials to Pine-Bailey Processing Area.[1/]

	Lowest Cost	Average Cost	Highest Cost
Stumpage (sawtimber)	$2.00/mbf	$9.29/mbf	$19.49/mbf
Harvesting (sawtimber)	38.84/mbf[2/]	45.24/mbf	50.08/mbf
Transportation Costs			
Sawtimber	7.37/mbf	8.66/mbf	9.49/mbf
Total Delivery Costs[3/]			
Sawtimber	64.06/mbf	73.69/mbf	80.13/mbf

SOURCES:

[1/] From three 1975 USFS appraisals, no firewood or poletimber appraisals were available.

[2/] Net indicated stumpage $-12.72 (negative).

[3/] Includes profit and risk.

REFERENCES

References 1 through 12 of the Fort Collins-Loveland Study were utilized in this case study. The following are cited in addition to these references.

13. Rand McNally. 1977. Commercial Atlas and Marketing Guide. Rand McNally & Company, Chicago, Illinois.
14. USDA Forest Service. 1976. Regional Resource Planning Act Printouts (1979) for the Arapaho National Forest. Region 2 Timber Inventory, Fort Collins, Colorado.
15. USDA Forest Service. 1963 Timber Management Plan for Pike National Forest. Region 2 Office, Denver, Colorado.

AGENCIES CONSULTED

1. C.S.F.S. State Office. Fort Collins, Colorado
2. C.S.F.S. Golden District Office. Golden, Colorado
3. U.S.D.A. Forest Service. Pike-San Isabel Supervisors Office. Pueblo, Co.
4. U.S.D.A. Forest Service. Arapaho-Roosevelt Supervisors Office. Fort Collins, Co.
5. U.S.D.A. Forest Service, S. Platte River Ranger District, Denver, CO.
6. U.S.D.A. Forest Service. Rocky Mountain Experiment Station, Fort Collins,Co.
7. U.S.D.A. Forest Service, Regional Office. Denver, Co.
8. U.S.D.I. Bureau of Land Management, State Office, Denver, Co.
9. U.S.D.I. Bureau of Land Management, Canon City District Office, Canon City, Co.

CASE STUDY V: COLORADO SPRINGS TRIBUTARY AREA

Summary

The Colorado Springs tributary area has 1,006,654 mcf of living raw material within its boundaries. Information was limited for the Pike-San Isabel National Forest. This limited availability of accurate and recent data for the Pike-San Isabel National Forest affects the accuracy of this report considerably. However, at this point in time, the 1962-63 TMPs that were utilized for the Pike-San Isabel are the best sources of data available.

This case study required only area adjustment factors for the national forest lands and Jefferson County state and private lands. The tributary boundary was based on consultation with the timber management office of the Pike-San Isabel National Forest, various USFS and CSFS districts, and the wood using industry in Colorado Springs. The tributary boundary, as in the other case studies, should not be considered absolute. For example the southern portion of the boundary is along Fremont County line, although close to the actual procurement area, represents an attempt to improve the accuracy of the volumetric data of this report. It is doubtful that in actuality the procurement area to any processing center would be a perfectly straight line as that which occurs along the northern portion of Fremont County. Accuracy, however, is improved since no area adjustment factors are therefore needed for state and private data.

The total live dead material for the Colorado Springs tributary area is 123,978 mcf. The total sound dead is 91,718 mcf. The 1976 mortality due to beetle kill for ponderosa pine was 2,448 mcf. The build-up ratio for this tributary area is higher (1:1.35) than for the northern portion of the area of concern (1:1). This means that in 1977 there will be an estimated 35% increase in ponderosa pine mortality caused by the mountain beetle, if the present trend continues. Also, the average size of the beetle killed trees in this tributary area and the Canon City-Florence tributary area is larger (12.9 cu. ft./stem) than the northern portion of the Front Range (10.5 cu.ft./stem). The non-CFL land contains a volume of 171,133 mcf.

The total potential cut is 7,624 mcf/year. Only about 1,616 mcf/year is presently being harvested. If a large scale thinning program was implemented the potential volume would be 11,575 mcf. Both the Pike and San Isabel National

Forests have low potential yields compared to the national forests in the northern portion of the area of concern.

The total wood utilization capacity for the Colorado Springs processing site is 1238.7 mcf/year, which would yield 585.4 mcf of by-products. The average value of rough cut lumber at present is 150/mbf. The products produced and marketing outlets in the Colorado Springs processing center are very unsophisticated for a city of 176,000 people with extensive transportation facilities and an above average transportation system.

Compared with other processing centers Colorado Springs does seem to have a slightly higher wood procurement cost. The average cost of obtaining wood raw material at the processing center is $99.93/mbf. This figure includes profit and risk. The average harvesting costs were 48.24/mbf and transportation costs were $22.00/mbf. The stumpage cost averages $3.50/mbf.

INTRODUCTION

The Colorado Springs tributary area is illustrated by Figure V-1. The area includes the Pike, San Isabel and Arapaho National orests. The boundary was constructed after interviews with the Pike-San Isabel National Forest Timber Management Office, the Colorado Springs Ranger District, the Woodland Park and Canon City district offices of the CSFS, and the wood processors of the Colorado Springs processing center.

The Colorado Springs processing center has 27 trucking companies which offer interstate and intrastate delivery. The railroad freight service is provided by Rock Island, Denver and Rio Grande, Santa Fe and Burlington lines. The major highways are Interstate 25, U.S. 24 and Colorado 94.

The area adjustment factors applied in this case study are as follows: Pike National Forest, .987; Arapaho National Forest, .276; San Isabel National Forest, .016. An area adjustment factor of .598 was applied to Jefferson County. No other area adjustment factors are necessary since either all of the counties are included within the tributary boundary, or only part of a county is included but that portion represents all of the forested area of that county. The accessibility factors remained unchanged, .5 for the Pike-San Isabel National Forest and .519 for the Arapaho National Forest.

The quality of the San Isabel National Forest data is equal to that of the Pike National Forest. The same procedures are utilized in this case study as the previous studies. However, different volume factors and build-up ratios are applied in determining beetle kill losses.

Live Material

The information concerning live material is given on Table V-1. The Arapaho 1977 RPA computer printouts were the only data source utilized from that forest. This is because the TMP presents information by forest district in a form that is not suitable for the taxonomy used in this report. Information supplied by the Pike-San Isabel TMPs is from 1962 and the land use information (i.e., percentage of land in standard, special, etc.) had to be estimated.

The volume for Elbert County was taken from a CSFS estimate. There is no TRI currently available for Elbert County. The previous assumptions and procedures explained and illustrated in the earlier studies still apply.

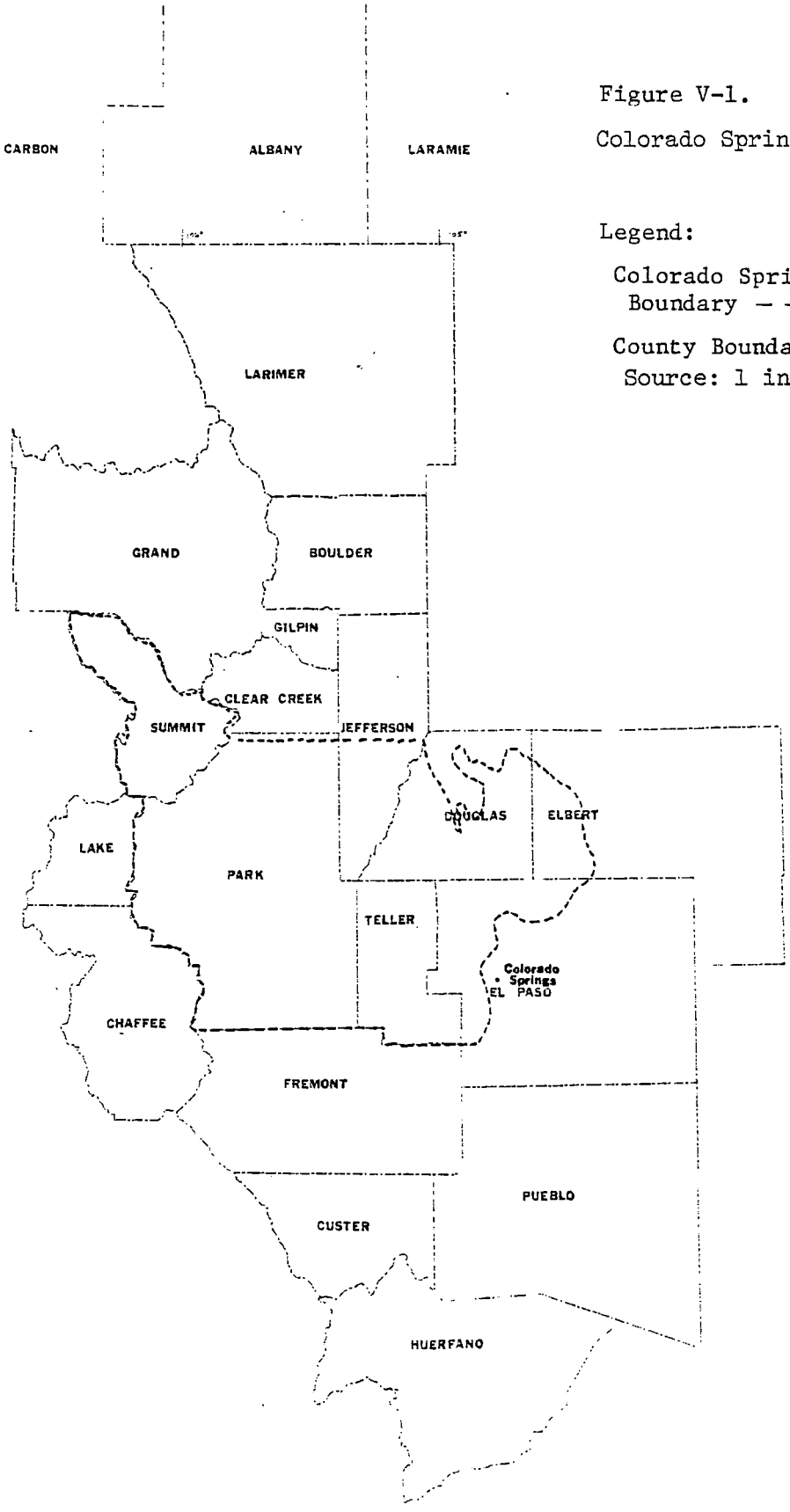

Figure V-1.

Colorado Springs Tributary Area

Legend:

Colorado Springs Tributary Boundary — — — — —

County Boundaries — - — - —

Source: 1 inch = 34 miles

Table V-1

COLORADO SPRINGS TRIBUTARY AREA LIVE CFL LANDS

	Jefferson Co. TRI #15		Summit Co. TRI # 5		Douglas Co. TRI #19		Elbert Co. C.S.F.S. Est.		Park Co. TRI #16		Teller Co. TRI #12		ElPaso Co. TRI #19		Pike N. F. 1963 TMP	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber																
Spruce-fir type	0	0	4,700	14,891	0	0	0	0	8,000	18,534	2,500	3,138	2,300	5,103	71,604	154,012
Douglas-fir type	8,079	7,153	0	0	3,000	2,524	0	0	1,800	1,460	3,900	3,234	4,600	5,890	81,921	66,101
Lodgepole pine type	0	0	3,700	9,746	0	0	0	0	0	0	0	0	0	0	15,792	35,959
Ponderosa pine type	21,785	20,409	0	0	16,000	13,984	5,000[1]	4,634[2]	8,900	5,595	2,500	2,036	7,700	7,543	115,479	93,178
Aspen type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	499	538
Total Sawtimber	29,864	27,562	8,400	24,637	19,000	16,508	5,000	4,634	18,700	25,589	8,900	8,408	14,600	18,536	300,095[3]	349,788
Poletimber																
Spruce-fir type	1,018	2,625	3,700	5,570	0	0	0	0	20,600	36,644	13,200	16,449	3,100	9,496	11,351	9,685
Douglas fir type	17,176	17,727	0	0	7,600	5,740	0	0	10,300	8,554	19,500	18,464	7,000	8,986	23,194	23,418
Lodgepole pine type	11,132	13,287	19,500	27,338	0	0	0	0	6,300	9,549	0	0	0	0	23,688	27,443
Ponderosa pine type	11,611	11,973	0	0	9,900	8,688	N/A	N/A	800	478	7,800	6,664	20,100	21,714	9,870	3,540
Aspen type	508	941	900	702	0	0	0	0	3,700	3,237	5,300	6,023	200	342	30,104[4]	32,783
Total poletimber	41,445	46,553	24,100	33,619	17,500	14,428	N/A	N/A	41,700	58,462	45,800	47,600	30,400	40,538	106,596[4]	96,869
Seedlings - Saplings																
Spruce-fir type	N/A	N/A	N/A	N/A	0	0	0	0	500	72	1,000	91	N/A	N/A	0	0
Douglas-fir type	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	N/A	N/A	800	N/A	1,481	N/A
Lodgepole pine type	3,052	279	2,800	1,288	0	0	0	0	900	N/A	0	0	0	0	494	N/A
Ponderosa pine type	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	800	650	1,974	N/A
Aspen type	508	116	N/A	N/A	0	0	0	0	2,800	214	4,500	799	1,300	667	4,442[5]	N/A
Total Seedlings-Saplings	3,560	395	2,800	1,288	N/A	N/A	N/A	N/A	4,200	286	5,500	890	2,900	1,317	8,883	N/A

Rough & Rotten Data N/A for any lands on this table

1) C.S.F.S. Estimate
2) Based on 926 Ft^3/AC, this an average of volume/acre for Ponderosa pine in Douglas and Elbert County
3) Includes 14,805 acres of white pine type, MCF not available
4) Includes 8,390 acres of white pine type, MCF not available
5) Includes 494 acres of white pine type, MCF not available.

Table V-1 (Continued)

Colorado Springs Tributary Area Live CFL Lands

	Arapaho N.F. 1979 RPA		San Isabel N.F. 1963 T.M.P.		Total for Table V-1 (2)	
	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber						
Spruce-fir type		80,066	861	2,016		
Douglas-fir type		0	568	759		
Lodgepole pine type		63,547	200	376		
Ponderosa pine type		0	491	288		
Aspen type		3,558	42	46		
Total Sawtimber	N/A	147,768 1)	2,162	3,485	406,721	626,915
Poletimber						
Spruce-fir type		2,443	428	365		
Douglas-fir type		0	356	360		
Lodgepole pine type		17,164	573	874		
Ponderosa pine type		0	175	625		
Aspen type		4,110	661	763		
Total Poletimber	N/A	23,717	2,193	2,987	309,734	364,773
Seedlings-Saplings						
Spruce-fir type		4,085	16	N/A		
Douglas-fir type		401	8	N/A		
Lodgepole-pine type		1,446	104	N/A		
Ponderosa pine type		0	0	N/A		
Aspen type		858	192	N/A		
Total Seedlings-Saplings	N/A	6,790	320	4,000	28,163	14,966

1) Includes 597 MCF of white pine type

2) Refer to footnote (4) of Table I-1.

Dead Material

Table V-2 contains the information for dead material. Only the Arapaho National Forest had information concerning dead material that was of the quality necessary for this report. For the Pike-San Isabel National Forest and state and private lands, the appropriate volume per acre factors were applied.

No information was available as to forest type make-up of non-CFL lands. Most of it is probably lodgepole pine or spruce. According to a forest type map of the CSFS, most of the forest land is ponderosa pine.

A build-up ratio of 1:1 was applied to Jefferson and Douglas Counties to predict the 1977 mortality due to the mountain pine beetle. In the remaining counties a 1:1.35 build-up ratio was applied to present losses to predict the 1977 losses. These build-up ratios are based on information supplied by the U.S.Forest Service Regional Office. This build-up ratio indicates that the epidemic is growing at a faster rate in the southern portion of the area of concern than in the northern portion. The build-up ratio for the northern portion of the area of concern is 1:1. Also the average size of the trees lost to the mountain pine beetle are larger in the southern portion of the Front Range. The average tree lost to the mountain pine beetle is 11.33 inches dbh. Using the average height of a beetle kill tree as being 55 feet, this works out to 12.9 cu ft. of wood material per tree. In the northern portion of the area of concern 10.5 cu. ft/stem was the average volume of mortality caused by the mountain pine beetle.

Potential Yield and Current Cut

Table V-3 depicts the information obtained concerning potential yield and current cut. Just as in the Pine-Bailey case study the potential volume from ponderosa pine thinnings greatly exceeds the potential volume for the Pike National orest, and is nowhere near the current cut. This could be due to an inaccuracy in the adjustment factors in calculating the appropriate acreages of ponderosa pine. More likely, the difference in volumes for potential yield and potential volume from thinnings is due to the comparatively low potential yield that the Pike and the San Isabel National Forests have in relation to national forests in the northern portion of the area of concern. The potential volume from ponderosa pine is very close or equal to the potential yield for the San Isabel National Forest and the state and pri-

Table V-2

COLORADO SPRINGS TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON CFL MATERIAL

	Jefferson Co.		Summit Co.		Douglas Co.		Elbert Co.		Park Co.		Teller Co.		El Paso Co.		Pike N.F.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5 Year Mortality (Standing)																
Spruce-fir type	0	0		6,980		0	0	0		23,767		13,047		4,487		68,936
Douglas-fir type	N/A	N/A		N/A	N/A		0	0		N/A		N/A		N/A		N/A
Lodgepole pine type	N/A	N/A		N/A	N/A		0	0		N/A		N/A		N/A		N/A
Ponderosa pine type	N/A	N/A		N/A	N/A		N/A	N/A		N/A		N/A		N/A		N/A
Aspen type	N/A	N/A		N/A	N/A		0	0		N/A		N/A		N/A		N/A
Total 5 year Mortality	N/A	N/A	N/A	6,980	N/A	N/A	N/A	N/A	N/A	23,767	N/A	13,047	N/A	4,487	N/A	68,936
Sound Dead (Down)																
Spruce-fir type		N/A		N/A		N/A	0	0		N/A		N/A		N/A		N/A
Douglas-fir type		N/A		N/A		N/A	0	0		N/A		N/A		N/A		N/A
Lodgepole pine		15,345		19,140		0	0	0		5,198		7,878		0		32,610
Ponderosa pine type		N/A		N/A		N/A	N/A	N/A		N/A		N/A		N/A		N/A
Aspen type		N/A		N/A		N/A	0	0		N/A		N/A		N/A		N/A
Total Sound Dead	N/A	15,345	N/A	19,140	N/A	N/A	N/A	N/A	N/A	5,198	N/A	7,878	N/A	0	N/A	32,610
Non CFL Lands																
Live	N/A	15,895	N/A	1,150	N/A	5,506	N/A	3,025	N/A	34,304	N/A	14,278	N/A	15,246	N/A	45,572
Dead	N/A	289	N/A	21	N/A	100	N/A	55	N/A	624	N/A	260	N/A	277	N/A	828
Total Non-CFL	26,273	16,184	1,900	1,171	9,100	5,606	5,000	3,080	56,700	34,928	23,600	14,538	25,200	15,523	75,326	46,400
	# of stems		# of stems		# of stems		# of stems		# of stems		# of stems		# of stems		# of stems	
PP Beetle kill Mortality																
Ponderosa pine 1977	58,604	615	0	0	4,000	42			3,645	47	2,066	27	7,860	101	35,256	455
Ponderosa pine 1976	58,604	615	0	0	4,000	42			2,700	1) 35 1)	1,530	20	6,000	77	26,913	347
Total Beetle Kill Mortality	117,208	1,230	0	0	8,000	84	N/A	N/A	6,345	82	3,596	47	13,860	178	62,169	802

For the Southern portion of the front range the build-up ratio is 1.35, the Adj.Vol/tree is 12.90 cu/ft.

Table V-2 Continued

COLORADO SPRINGS TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL

	Arapaho N.F. 1979 R.P.A.		San Isabel N.F.		Total of table V-2 (3)	
	Acres	MCF	Acres	MCF	Acres	MCF
5 year Mortality (standing)						
Spruce-fir type		4,170[2]		1,071		
Douglas-fir type		0		N/A		
Lodgepole pine type		1,449		N/A		
Ponderosa pine type		0		N/A		
Aspen type		71		N/A		
Total 5-year Mortality	N/A	5,690	N/A	1,071	N/A	123,978
Sound Dead (Down)						
Spruce-fir type		5,752		N/A		
Douglas-fir type		0		N/A		
Lodgepole pine type		5,081		638		
Ponderosa pine type		0		N/A		
Aspen type		76		N/A		
Total Sound Dead	N/A	10,909[1]	N/A	638	N/A	91,718
Non-CFL Lands						
Live	N/A	31,359	N/A	1,742		
Dead	N/A	570	N/A	32		
Total Non-CFL Lands	51,833	31,929	2,880	1,774	277,812	171,133
	# of stems		# of stems		# of stems	
P. P. Beetle Kill Mortality						
Ponderosa pine 1977	185	2	958	12		1,301
Ponderosa pine 1976	185	2	732	9		1,147
Total Beetle Kill Mortality	370	4	1,690	21	213,238	2,448

1) Plus 256 MCF of white pine type, sound dead
2) 5 yr. mortality is by species, spruce-fir is composed of engelmann spruce & subalpine fir. Sound dead is reported by forest type
3) Refer to footnote (4) of Table I-1.

Table V-3

ANNUAL POTENTIAL YIELD AND PROGRAMMED CURRENT CUT FOR COLORADO SPRINGS TRIBUTARY AREA

	Pike N.F. TMP Amendment		San Isabel N.F. TMP Amendment		Arapaho N.F.		State & Private		Total of Table V-3[1]	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Potiential Yield										
Standard		1,019		14	3,962	416	Sawtimber	1,715		
Special		1,152		18	5,720	646	Poletimber	2,644		
Total	N/A	2,171	N/A	32	9,682	1,062	N/A	4,359	9,682	7,624
Annual Programmed Current cut										
Standard		N/A		N/A	469	577				
Special		N/A		N/A	235	163				
Total	N/A	876	N/A	14	704	740	N/A	N/A	704	1,616
Potential Vol From Ponderosa Pine Thinnings										
Sawtimber	115,479	6,929	491	29	0	0	61,885	3,713		
Poletimber	2,467	148	44	3	0	0	12,553	753		
Total	117,946	7,077	535	32	0	0	74,438	4,466	192,919	11,575

(1) Refer to footnote (4) in Table I-1.

vate lands for this tributary area which is predominantly ponderosa pine forest type except for the Summit County area.

Wood Processors Information

Colorado Springs had relatively few operators for such a large metropolitan area close to the wood resource. The wood processors which are included in this case study are listed on Table V-4. Table V-5 through V-7 show product values, capacity,and wood procurement costs.

This processing center is still comparatively unsophisticated for the area of concern, which is somewhat surprising for a city this size. Rough cut lumber and firewood are the primary products. The rough cut lumber is valued at $150/mbf. Much of the material produced at this processing center is marketed to Pueblo for consumption by the steel industry. The cost of obtaining raw material in this tributary seems somewhat higher than costs in the northern portion of the Front Range. In particular harvesting costs seem to run somewhat higher. Why this is so was not answered satisfactorily. However, it is probably due to a combination of factors including smaller sales, rougher terrain and more extensive slash treatment than in the northern portion of the Front Range. As usual, the sampling of appraisals was limited. Appraisals for 1975 were used in computing costs for Table V-7. Also as was usually the case throughout this report, the wood processors themselves have little or no cost breakdowns for their operations.

The population and transportation facilities for Colorado Springs is shown on Table V-8 and V-9. The transportation facilities available to this processing center are excellent. The transportation characteristics for the tributary area are above average. Douglas, Elbert and El Paso Counties have good transportation systems. Summit and Jefferson Counties are average, with Park County being somewhat below average.

TABLE V-4 Wood Processors in the Colorado Springs processing center which make up the present day capacity

Double K Enterprises
1629 Berglind Road
Colorado Springs 80918

Hart Bros.
Black Forest Road
Colorado Springs 80908

Kirkpatrick Bros.
Black Forest Road
Colorado Springs 80908

Mental Retardation Center
Weber Street
Colorado Springs 80902

Old Town Lumber and Milling
2700 Robinson
Colorado Springs 80902

Francis Stage
2700 Robinson
Colorado Springs 80900

16 Firewood Dealers

TABLE V-5 Colorado Springs Product Values
(F.O.B. Mill)

PRODUCT	DOLLARS/EACH	DOLLARS/MBF OF FINISHED PRODUCT	DOLLARS/MCF FINISHED PRODUCT
Pallets	5.00/pallet	250	3000
Dunnage	5.00/dunnage	250	3000
Timbers (untreated)	3.50/piece	160	1920
Rough boards		150	1800
Planed boards		190-210	
Barn poles	13.40/piece	284	3408
Corral poles	2.35/piece	251	3012
Fence posts	1.75/piece	339	4069
Dimension lumber		200	2400
R. R. ties (untreated)	3.36/piece	155	1860
Wedges (1)	.08/piece	333	4000
Beams		220-240	4022-4388
Firewood	45.00/cord	44	529
Chips	1.00/yard	--	37
Shavings	1.00/yard	--	37
Sawdust	1.00/yard	--	37

(1) Wedges are a product used to tighten mining timbers

TABLE V-6 Colorado Springs Existing Wood Utilization Capacity [1/]

Mill Capacity MCF/year	Products
15.6	Pallets
13.7	Dunnage
2.0	Timber
422.3	Rough boards
15.7	Planed boards
18.8	Barn poles
3.7	Corral poles
15.5	Fence posts
2.6	Paneling
58.6	Dimension lumber
489.6	Firewood
168.1	R. R. ties (decorative)
2.0	Wedges
10.5	Beams
1238.7	
	BY-PRODUCTS:
383.9	Chips
187.5	Sawdust
14.0	Shavings
585.4	

1/ Refer to Table I-6 footnote.

TABLE V-7 Costs of Delivering Raw Materials to Colorado Springs Processing Center[1/]

	Lowest Costs	Average Costs	Highest Costs
Stumpage (sawtimber)	$2.00[2/]/MBF	$3.50/MBF	$7.46/MBF
Harvesting (sawtimber)	45.11/MBF	48.24/MBF	51.37/MBF
Transportation costs to Colorado Springs (sawtimber)	21.49/MBF	22.00/MBF	22.50/MBF
Total Delivery[3/] costs (sawtimber)	95.63/MBF	99.93/MBF	104.22/MBF

1/ From 1975 USFS appraisals that sold sales assumed to be approximately the same size in volume (No fuelwood appraisals were available).

2/ Indicated net stumpage $-57.48 (negative).

3/ Includes profit and risk.

TABLE V-8 Colorado Springs Population[1/]

	Colorado Springs
1970	135,060
1975	176,000
1980	210,000

Source:

1/ Economic Development Department, Colorado Springs Chamber of Commerce

TABLE V-9 Colorado Springs Transportation Facilities [1/]

Motor Freight Carriers: Colorado Springs is served by 27 trucking companies which offer interstate and intrastate delivery.

Freight Service: Provided by four railroads: Rock Island, Denver and Rio Grande, Santa Fe and Burlington Lines.

1/ Economic Development Department, Colorado Springs, Chamber of Commerce

REFERENCES

References 1 through 11 of the Fort Collins-Loveland study were utilized in this case study. The following were cited in addition to those references.

12. U.S.D.A. Forest Service 1976. Regional Resource Planning Act Printouts (1979) for the Arapaho National Forest Region 2 Timber Inventory, Fort Collins, Colorado.

13. U.S.D.A. Forest Service. 1963-62 Timber Management Plans for the Pike and San Isabel National Forests. Region 2 Office, Denver, Colorado.

Agencies Consulted

1. CSFS. State Office. Fort Collins, Colorado
2. CSFS. Golden District Office. Golden, Colorado.
3. CSFS. Woodland Park District Office. Woodland Park, Colorado.
4. Department of Commerce. Colorado Springs, Colorado.
5. USDA Forest Service. Pike-San Isabel Supervisor's Office. Pueblo, Colo.
6. USDA Forest Service. Pikes Peak Ranger District. Colorado Springs, Colo.
7. USDA Forest Service. Rocky Mountain Experiment Station, Fort Collins, Colo.
8. USDA Forest Service. Regional Office. Denver, Colorado.
9. USDI Bureau of Land Management, Canon City District Office, Canon City, Colo.

CASE STUDY VI: CANON CITY-FLORENCE TRIBUTARY AREA

Summary

The Canon City-Florence tributary area has 1,130,986 mcf of living raw material. Basically, this case study utilizes the same sources of data as the Colorado Springs case study and is equal in reliability to the Colorado Springs case study. The tributary area was determined by utilizing information supplied by the CSFS, the Timber Management Offices of the Pike-San Isabel National Forest, the BLM district office in Canon City and the wood processors of the Canon City-Florence processing area.

The total five-year mortality was 174,430 mcf and there was 81,111 mcf of sound dead within this tributary area. The non-CFL lands contained 224,099 mcf of wood material. This data was acquired exclusively via use of volume per acre adjustment factors as described earlier in this report. The ponderosa pine beetle kill was 638 mcf in 1976. This mortality is expected to increase in 1977 to 836 mcf. This is a relatively small loss when compared with other tributary areas within the area of concern.

The total potential yield for the tributary area is 8,506 mcf/year. The current cut is 1,493 mcf/year. If a full scale thinning program was initiated a volume of 10,103 mcf/year would be harvested from the ponderosa pine lands which represent a major portion of the forest within this tributary area.

The average price of the primary product, rough cut lumber, was $150/mbf. The total wood utilization capacity was 836 mcf/year. By-products were being generated at the rate of 531.4 mcf/year. Cost information was limited, however, the figures seemed fairly reliable since the area is similar to Colorado Springs and the data compared favorably with figures for that tributary area. The total wood procurement cost to Canon City-Florence processing center was 93.05/mbf for sawtimber. The harvesting costs were $50.67/mbf. The harvesting costs are higher than the processing centers in the northern segment of the area of concern. The stumpage price of timber was 3.00/mbf. The cost of hauling was 21.09/mbf.

The population of the Canon City-Florence processing area was 18,500 in 1976. Numerous rail and motor freight facilities and services exist. However, the transportation network within the tributary area is below average.

INTRODUCTION

The outline of the Canon City-Florence tributary area is shown in Figure VI-1. Florence is not shown in Figure VI-1. The town is located seven miles southeast of Canon City. Agencies consulted to determine the tributary area were the CSFS Canon City District Office, the BLM Canon City District Office and the Timber Management Office of the Pike-San Isabel National Forest. The wood using industry of the Canon City-Florence area was also consulted.

The boundary coincides with county lines or with the area in which beetle infestations are occurring. The tributary area covers very light beetle infestations which are occurring in Huerfano County. The area adjustment factors are as follows: .785 for the Pike National Forest; .896 for the San Isabel National Forest and .074 for the Huerfano County area. A .5 accessibility factor was utilized for the Pike-San Isabel National Forest.

The major highways are State Highways 115, 9, 69, 67 and U. S. Highway 50. Canon City is serviced by Atchison, Topeka & Santa Fe and Denver & Rio Grande Western Railroads. There are also numerous motor carriers which service the Canon City-Florence processing center.

This case study is very similar to the Colorado Springs case study. In constructing tables VI-1 through 3, the same procedures concerning data acquisition and methodology exists in this case study as did in the Colorado Springs case study. The only difference is that different counties comprised of state and private land are considered here.

Live Raw Material

The data for live material is presented in Table VI-1. The accuracy of the Pike-San Isabel National Forest, which comprises most of the tributary area, is questionable. As in the Colorado Springs case study there isn't any information available concerning rough and rotten volumes. It is quite probable That these values are near zero. This is because the CSFS probably considered the volume negligible when performing their timber surveys, and therefore did not include information for all size classes and/or forest types.

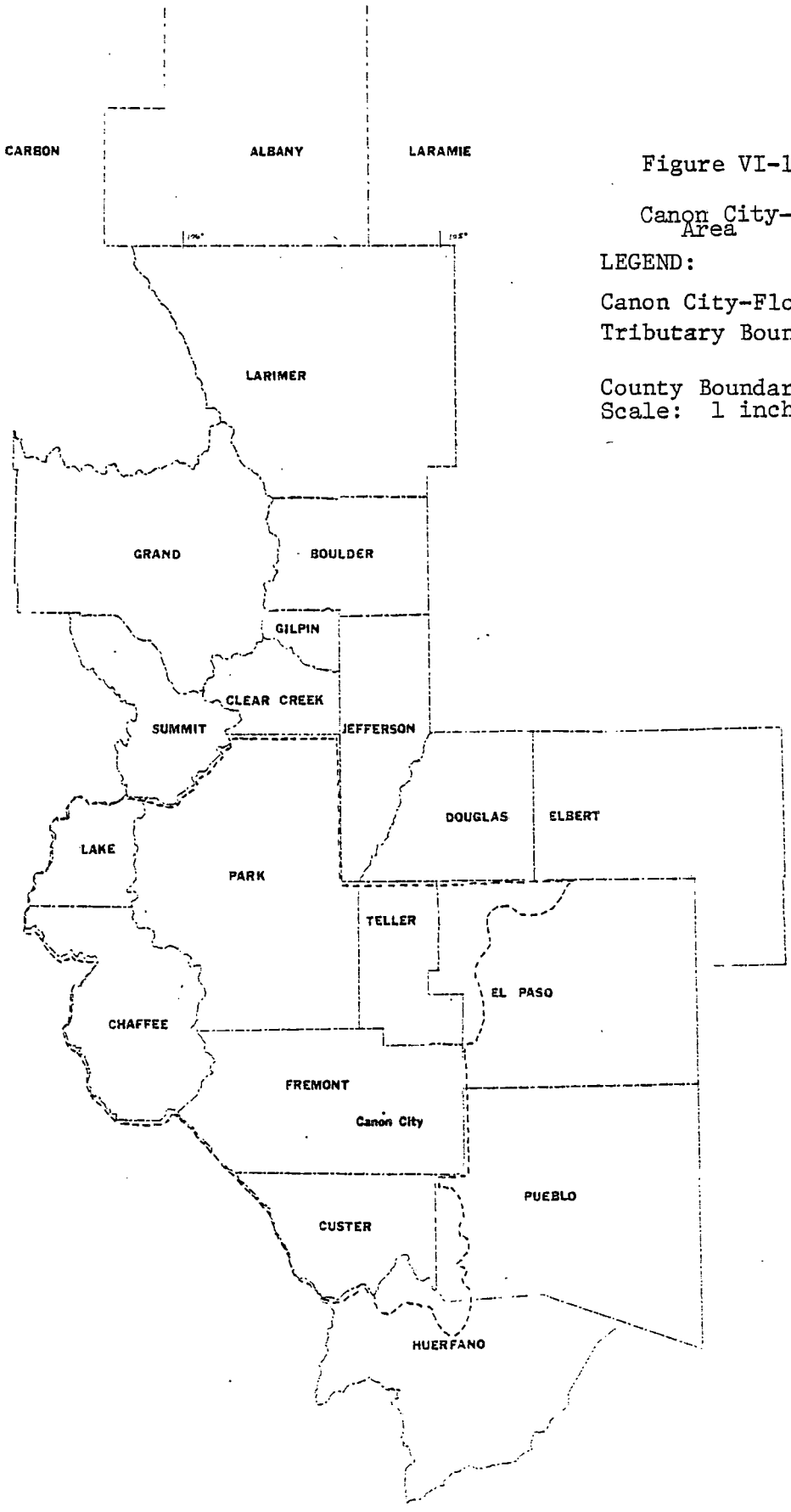

Figure VI-1.

Canon City-Florence tribut Area

LEGEND:

Canon City-Florence Tributary Boundary — — — —

County Boundary — - — - — -

Scale: 1 inch = 34 miles

Dead Raw Material

Table VI-2 indicates the data acquired concerning dead raw material and non-CFL lands. There are many "not available" symbols throughout the table just as in Table V-2 of the Colorado Springs case study. The usual procedures and factors were applied to determine dead volumes and volumes for non-CFL lands. The 1:1.35 build-up ratio was utilized to predict the 1977 beetle kill mortality and the 12.9 cu.ft./stem factor was applied to the air survey stem count to determine volumes of wood raw material that exist in beetle killed ponderosa pine.

Potential Yield and Programmed Current Cut

Table VI-3 presents the data concerning present and potential cutting levels within the Canon City-Florence processing area. The situation is similar to that of the Colorado Springs case study. The potential yields are quite high when compared to the current cut. The potential volume from ponderosa pine thinnings exceed or approach the potential yields for the various forest ownerships inside the tributary area. The reason such comparatively high volumes of ponderosa pine are thinned in relation to the potential yield is because there exists a relatively large acreage of ponderosa pine forest type within this tributary area. This acreage would generate large volumes of wood when thinned in a short 5 year time period.

Tables VI-4 through 6 present the information concerning the processors examined for this case study, their current product values, and their current wood utilization capacities. As can be seen from the tables, this is a comparatively small processing center. The mills in this area were, as usual, very simplistic in their operations and were unable to provide accurate cost information. Only one current USFS appraisal was available. It is interesting to note that the wood procurement costs are higher than for the northern processing centers. This was due to the relatively high logging costs. Despite this USFS appraisal being the only source of cost information it probably accurately represents the existing economic situation. Especially since the area is similar to Colorado Springs which operates with like terrain and ownership patterns and this appraisal's figures closely resemble the ones used in the Colorado Springs study.

The population and transportation facilities are listed in Table VI-8. The transportation characteristics of the tributary area are below average. This is because large areas such as Park, Fremont, Custer, and Huerfano Counties with relatively poor transportation systems. Other counties within the tributary area have average or good transportation systems. However these counties are located more distant from the processing center.

Table VI-1

CANON CITY-FLORENCE TRIBUTARY AREA LIVE CFL LAND

	Park Co. TRI #16		El Paso Co. TRI#19		Lake Co. TRI #16		Fremont Co. TRI#12		Chaffee Co. TRI#16		Teller Co. TRI#12		Custer Co. TRI #12		Pueblo County TRI#3	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber																
Spruce-fir type	8,000	18,534	2,300	5,103	900	3,525	800	751	500	1,068	2,500	3,138	5,200	15,732	0	0
Douglas-fir type	1,800	1,460	4,600	5,890	N/A	N/A	10,500	11,496	2,300	2,699	3,900	3,234	9,900	18,466	2,700	2,593
Lodgepole pine type	0	0	0	0	0	0	N/A	N/A	300	236	0	0	N/A	N/A	0	0
Ponderosa pine type	8,900	5,595	7,700	7,543	N/A	N/A	3,600	4,031	3,600	2,840	2,500	2,036	5,500	7,512	2,700	1,999
Aspen type	0	0	0	0	0	0	2,300	3,280	200	239	0	0	1,100	1,542	0	0
Total Sawtimber	18,700	25,589	14,600	18,536	900	3,525	17,200	19,558	6,900	7,082	8,900	8,408	21,700	43,252	5,400	4,592
Poletimber																
Spruce-fir type	20,600	36,644	3,100	9,496	5,400	7,759	3,800	6,316	500	451	13,200	16,449	3,400	10,489	0	0
Douglas-fir type	10,300	8,554	7,000	8,986	N/A	N/A	9,400	10,303	1,800	1,450	19,500	18,464	11,800	15,262	4,100	4,107
Lodgepole pine type	6,300	9,549	0	0	12,615	22,715	N/A	N/A	2,200	2,983	0	0	2,200	N/A	0	0
Ponderosa pine type	800	478	20,100	21,714	N/A	N/A	800	500	800	478	7,800	6,664	1,500	1,210	6,800	4,363
Aspen type	3,700	3,237	200	342	1,500	1,639	6,200	7,427	1,900	2,414	5,300	6,023	9,900	21,941	1,300	1,911
Total poletimber	41,700	58,462	30,400	40,538	19,515	32,113	20,200	24,546	7,200	7,776	45,800	47,600	28,800	48,902	12,200	10,381
Seedlings-Saplings																
Spruce-fir type	500	72	N/A	N/A	N/A	N/A	0	0	N/A	N/A	1,000	91	0	0	0	0
Douglas-fir type	N/A	N/A	800	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	0	0	0	0
Lodgepole pine type	900	N/A	0	0	2,000	511	0	0	300	6	N/A	N/A	0	0	0	0
Ponderosa pine type	N/A	N/A	800	650	N/A	N/A	0	0	N/A	N/A	N/A	N/A	0	0	0	0
Aspen type	2,800	214	1,300	667	1,100	234	0	0	N/A	N/A	4,500	799	500	N/A	0	0
Total Seedlings & Saplings	4,200	286	2,900	1,317	3,100	745	0	0	300	6	5,500	890	500	N/A	0	0

Table VI-1 Continued

CANON CITY-FLORENCE TRIBUTARY AREA, LIVE CFL LAND

	Huerfano Co. TRI #2		Pike N.F. 1963 TMP		San Isabel N.F. 1963 TMP			Total of Table[4] VI-1	
	Acres	MCF	Acres	MCF	Acres	MCF		Acres	MCF
Sawtimber									
Spruce-fir type	1,206	1,384	56,520	122,491	48,181	112,916			
Douglas fir type	0	0	65,155	52,572	31,786	42,472			
Lodgepole pine type	0	0	12,560	28,599	11,203	21,058			
Ponderosa pine	400	226	91,845	74,108	27,494	16,126			
Aspen type	200	464	393[1]	427	2,352	2,562			
Total Sawtimber	1,806	2,074	238,249	278,197	121,016	195,134		455,371	605,947
Poletimber									
Spruce-fir type	807	876	9,028	7,703	23,961	20,445			
Douglas fir type	0	0	18,448	18,625	19,934	20,126			
Lodgepole pine type	0	0	18,840	21,826	32,099	48,909			
Ponderosa pine type	400	298	7,850	2,816	9,763	35,015			
Aspen type	807	1,028	23,942[2]	26,074	39,235	42,739			
Total Poletimber	2,014	2,202	84,783	77,044	124,992	167,234		417,604	516,798
Sapling - Seedlings									
Spruce-fir type			0	0	896	N/A			
Douglas-fir type			1,178	N/A	448	N/A			
Lodgepole pine type			393	N/A	5,824	N/A			
Ponderosa pine type			1,570	N/A	0	N/A			
Aspen type			3,535[3]	N/A	10,752	N/A			
Total Seedling-Saplings	N/A	N/A	7,069	1,413	17,920	3,584	41,219	41,219	8,241

1) Includes 11,776 acres of white pine type; MCF not available
2) Includes 6,673 acres of white pine type; MCF not available
3) Includes 393 acres of white pine type; MCF not available.
4) Refer to footnote (4) of Table I-1.

Table VI-2 CANON CITY - FLORENCE TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON - CFL MATERIAL

	Park County		El Paso Co.		Lake Co.		Fremont Co.		Chaffee Co.		Teller Co.		Custer Co.		Pueblo Co.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5-year mortality (standing)																
spruce-fir type		23,767		4,487		5,235		3,823		831		13,047		7,147		0
Douglas-fir type		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Lodgepole pine type		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Ponderosa pine type		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Aspen type		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Total 5-year Mortality	N/A	23,767	N/A	4,487	N/A	5,235	N/A	3,823	N/A	831	N/A	13,047	N/A	7,147	N/A	N/A
Sound dead (Down)																
Spruce-fir type		N/A	N/A	N/A		N/A				N/A		N/A		N/A		N/A
Douglas-fir type		N/A	N/A	N/A		N/A				N/A		N/A		N/A		N/A
Lodgepole pine type		5,198		0		10,407				2,062		0		1,815		0
Ponderosa pine type		N/A		N/A		N/A				N/A		N/A		N/A		N/A
Aspen type		N/A		N/A		N/A				N/A		N/A		N/A		N/A
Total Sound Dead	N/A	5,198	N/A	N/A	N/A	10,407	N/A	N/A	N/A	2,062	N/A	N/A	N/A	1,815	N/A	N/A
Non-CFL Lands																
Live		23,203		15,246		2,178		7,078		4,598		14,278		2,178		5,566
Dead		624		277		40		129		84		260		40		101
Total Non-CFL Lands	56,700	34,928	25,200	15,523	3,600	2,218	11,700	7,207	7,600	4,682	23,600	14,538	3,600	2,218	9,200	5,667
	# of stems		# of stems		# of stems		# of stems		# of stems		# of stems		# of stems		# of stems	
PP Beetle kill Mortality																
Ponderosa pine 1977	3,645	47	7,860	101	0	0	2,620	34	2,066	27	2,004	26	6,550	84	655	8
Ponderosa pine 1976	2,700	35	6,000	77	0	0	2,000	26	1,530	20	1,530	20	5,000	65	500	6
Total Beetle Kill Mortality	6,345	82	13,860	178	0	0	4,620	60	3,596	47	3,534	46	11,550	149	1,155	14

Table VI-2 Cont. CANON CITY - FLORENCE TRIBUTARY AREA: DEAD MATERIAL, PONDEROSA PINE BEETLE KILLED MATERIAL AND NON-CFL MATERIAL

	Huerfano Co.		Pike N. F.		San Isabel N.F.		Total for Table VI-2 1/	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
5-year Mortality (Standing)								
Spruce-fir type		1,673		54,470		59,950		
Douglas-fir type		N/A		N/A		N/A		
Lodgepole pine type		N/A		N/A		N/A		
Ponderosa pine type		N/A		N/A		N/A		
Aspen type		N/A		N/A		N/A		
Total 5-year mortality	N/A	1,673	N/A	54,470	N/A	59,950	N/A	174,430
Sound Dead (Down)								
Spruce-Fir type		N/A		N/A		N/A		
Douglas-fir type		N/A		N/A		N/A		
Lodgepole pine type		0		25,905		35,724		
Ponderosa pine type		N/A		N/A		N/A		
Aspen type		N/A		N/A		N/A		
Total Sound Dead	N/A	N/A	N/A	25,905	N/A	35,724	N/A	81,111
Non-CFL lands								
Live		851		36,245		97,574		
Dead		15		659		1,774		
Total Non-CFL Lands	1,407	866	59,909	36,904	161,279	99,348	363,795	224,099
P.P. Beetle Kill Mortality								
Ponderosa pine, 1977			28,597	369	10,873	140		836
Ponderosa pine, 1976			21,830	282	8,300	107		638
Total Beetle Kill Mortality	N/A	N/A	50,427	651	19,173	247	114,260	1,474

1/ Refer to footnote (4) of Table I-1.

Table VI-3 ANNUAL POTENTIAL YIELD AND PROGRAMMED CURRENT CUT FOR CANON CITY- FLORENCE TRIBUTARY AREA

	Pike N.F.		San Isabel		State & Private		Total for Table VI-3 1/	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Potential Yield								
Standard		810		856	Sawtimber	2,230		
Special		916		1,032	Poletimber	2,662		
Total	N/A	1,726	N/A	1,888		4,892	N/A	8,506
Current Cut								
Standard		N/A		N/A				
Special		N/A		N/A				
Total	N/A	697	N/A	796	N/A	N/A	N/A	1,493
Potential Volume from Ponderosa Pine thinnings/year								
Sawtimber	91,845	5,510	27,494	1,650	34,900	2,094		
Poletimber	1,963	118	2,441	146	9,750	585		
Total	93,808	5,628	29,935	1,796	44,650	2,679	168,393	10,103

1/ Refer to footnote (4) of Table I-1.

TABLE VI -4 Wood Processors in the Canon City-Florence Processing Area which make up the present day capacity

Assemble Homes Inc.
Roy Palmer, Manager
Box 186, 301 S. Union St.
Florence, O 81226

Hardin Sawmill
Richard A. Hardin
Canon City, Co.
81212

Cone Lumber Co.
Les Caughman
P. O. Box 168
Florence, CO 81226

Viola Bros.
James Viola
918 B. Street
Penrose, CO 81240

Everett C. Emond
P. O. Box 421
Canon City, CO 81212

5 Firewood Dealers

TABLE VI - 5 Canon City-Florence Product Values (F.O.B. Mill)

Product	Dollars each	Dollars/MBF of finished product	Dollars/MCF of finished product
Pallets	5.00/pallets	250	3000
Dunnage	5.00/dunnage	250	3000
Timbers (untreated)		160	1920
Rough Boards		150	1800
Fence Posts	1.75/piece	339	4069
Dimension Lumber		200	2400
R. R. Ties		155	1860
Firewood	45.00/cord	44	529
Chips	1.70/yard		49.76
Shaving	1.70/yard		49.76
Sawdust	1.70/yard		49.76

TABLE VI - 6 Canon City-Florence Existing Wood[1/] Utilization Capacity

Mill Capacity MCF/year		Products
156.4		Pallets
156.4		Dunnage
39.1		Timbers
215.1		Rough Boards
8.6		Fence Posts
29.3		Dimension Lumber
153.0		Firewood
78.2		R. R. Ties (DECORATIVE)
836.1		
356.0	By Products:	Chips
173.9		Sawdust
1.5		Shavings
531.4		

1/ Refer to Table I-6 footnote.

TABLE VI - 7 Costs of Delivering Raw Materials to the Canon City-Florence Processing Area[1/]

	lowest highest and average cost
Stumpage (sawtimber)	$3.00/MBF[2/]
Harvesting (sawtimber)	$50.67/MBF
Transportation (sawtimber)	$21.09/MBF
Total Delivery Costs (sawtimber)	$93.05/MBF[3/]

1/ One 1976 U.S.F.S. appraisal that sold. No information was available for fuelwood or poletimber

2/ Net indicated stumpage ($-17.28 negative)

3/ Includes profit and risk

TABLE VI - 8 Canon City-Florence Population[1/]

	1970	1976
Canon City	9,206	14,500
Canon Metro Area	--	18,500

Source: Canon City Department of Commerce

TABLE VI-9 Canon City-Florence Transportation Facilities

Motor Freight Carriers

- Rio Grande Motorway
- Yellow Freight
- United Parcel
- REA Express
- Northwest Transport and others

Railway Freight Service

- Atchison Topeka and Santa Fe
- Denver and Rio Grande Western

REFERENCES

References 1 through 10 of the Fort Collins-Loveland study were utilized in this case study. The following are cited in addition to those references.

11. U. S.D.A. Forest Service. 1963-62. Timber Management Plan for the Pike - San Isabel National Forests. Region 2 Office, Denver, Colorado.

Agencies Consulted

1. CSFS. State Office. Fort Collins, Colorado
2. CSFS. Canon City District Office. Canon City, Colorado.
3. Department of Commerce. Canon City, Colorado.
4. USDA Forest Service. Pike-San Isabel Supervisors Office. Denver, CO
5. USDA Forest Service. Rocky Mountain Experiment Station, Fort Collins, CO
6. USDA Forest Service, Regional Office. Denver, Colorado
7. USDI Bureau of Land Management, State Office. Denver, Colorado
8. USDI Bureau of Land Management, Canon City District Office, Canon City, Co.

Recommendations

The purpose of this section is to discuss the results of this study and to make recommendations as to what wood utilization strategies might be appropriate to accompany proposed silvicultural prescriptions to control the Mountain Pine Beetle infestation. This study does relate to factors, such as marketing, as presented in CSU Project 1412 "Production and Marketing Strategies for Utilizing Beetle-Killed and Associated Front Range Timber." This discussion and recommendations section makes only an introduction to some of the marketing factors more completely examined in the above-mentioned report.

The volumetric data on all timber is in most cases more accurate in the northern portion of the area of concern. However, beetle kill data reliability is equal throughout the area of concern since the information was based on the air survey and information supplied by the Forest Insect and Disease Management Group of the Regional Office. The reliability of this data is relatively good.

Unfortunately, the current timber utilization capacities of the Colorado Springs and Canon City-Florence processing centers are small in comparison to the Fort Collins-Loveland processing center. The marketing outlets of the mills in the southern portion of the area of concern are generally few. There is a tendency for the mill owners to concentrate on customers and to overlook development of possible new markets. It does not seem realistic to assume that utilization capacities for these processing centers would increase greatly in the forseeable future without some additional stimulus. In fact, several small mills operating during 1973-1975 have gone out of business and it does not seem likely that they will resume operation with any degree of stability. Many of the mills in this area seem to appear, operate intermittently and then go out of business. Unless this past trend can be broken, it seems that the production pattern will remain erratic and would severely limit the opportunity for utilization and, therefore, silvicultural control in the southern portion of the Front Range. However, Colorado Springs offers more potential than Canon City-Florence considering its transportation facilities, transportation characteristics, and labor supply.

From a salvage program viewpoint Fort Collins-Loveland exhibits the most potential. The Fort Collins processing center has the most wood utilization capacity in relation to the amount of mortality caused by the mountain pine

beetle. New products such as paneling are being produced and marketed at this processing center. Also integrated wood utilization possibilities exist because of existing wood treating facilities and established utilization of by-products for pulp and chips and animal bedding. The transportation facilities are good and the transportation system for the area is average. In the future this tributary should provide one of the most favorable areas for implementing an effective utilization-based silvicultural control program.

Based on its location the Pine-Bailey processing center offers excellent potential for salvage operations. However, its present limited processing capacity is a serious drawback. Realistically it does not seem that this area's processing capacity will grow in size considering past utilization trends, labor supply, and lack of transportational facilities.

The Boulder-Longmont processing area is another processing center which offers considerable potential for salvage operations and future long-term silvicultural control through utilization. The Boulder County infestations are very intensive. New sawmills and wood processors are entering this area (Boulder, specifically). If the present trend continues wood utilization capacity may increase enough to absorb the amount of raw material volume that would be generated by a full scale thinning program. Transportation facilities and characteristics for this processing area are above average and the labor supply is comparatively favorable. For these reasons, this area offers good potential for implementation of a thinning program.

Denver although the largest metropolitan area in the area of concern, was unusual in the sense that the area's large wood treatment facilities draw most of their wood products or raw materials from outside of Colorado. If this wood utilization capacity could be directed more towards Colorado resources, it could have a significant impact on beetle control programs. Houselogs are currently being produced in Denver on a fairly large scale. This may offer potential for utilization of ponderosa pine sawtimber. This processing center offers possibilities from the standpoint of the integrated wood utilization. The transportation facilities are the best in the area of concern and the transportation system is average. Also there should be an adequate labor supply.

It is important to note that no matter which processing center is discussed, none has the present day capability to utilize the material generated by a full-scale thinning program described of the scale projected in this study. Only in the Fort Collins-Loveland tributary area does the current cut of all

species exceed the potential volume of ponderosa pine thinnings. A considerable portion of the Fort Collins-Loveland tributary area's current cut is being utilized in Laramie, Wyoming. Therefore, not only are current cuts and wood utilization capacities for all species not equal to the volumes of ponderosa pine generated in an all-out thinning program, but these potential thinning volumes exceed even the potential yields (which are dictated largely by the national forests) in the southern portion of the Front Range. For these reasons such a large scale thinning program does not seem feasible and silvicultural goals should probably be reduced to a more realistic level.

Another point which should be mentioned is the lack of industry interest in harvesting ponderosa pine. Historically, most wood processors prefer lodgepole pine or spruce-fir timber. If silvicultural control for ponderosa pine is to be implemented this past trend would have to change. Although it is not within the scope of this report to examine all of the possibilities which may exist a few will be mentioned. Development of new products, marketing and utilization techniques are needed. New products such as fuel briquets made with chipable material offer possibilities. An initial investment of $5,000 for a typical small operator to produce such products in the area of concern seems more realistic in the foreseeable future than the longterm initial investment required for a particleboard plant which has been considered. Interest in blue stain paneling from beetle killed ponderosa pine is growing and seems to offer the most immediate potential as a new product. However, this is not a complete answer since a silvicultural control program would also generate green material not suitable for this product. The possibility of a dry kiln for cooperative use by Front Range mills has been discussed and may offer potential. This has been tried in Montana with some degree of success. A kiln would aid in improved quality control, extend product potentials and removal of insects in beetle killed wood. In order to increase ponderosa pine utilization capacities, the wood processors will have to be operating with marketing and utilization techniques different from those which have existed in the past. There seems to be a need for a marketing organization which could pool the products of small wood processors and explore new markets.

In summary the southern portion of the area of concern and in particular Colorado Springs tributary area offers the most realistic potential for silvicultural control of the mountain pine beetle. The Fort Collins-Loveland tributary has the best chance to succeed as a salvage operation and future longterm

control. New products, marketing strategies and utilization practices are needed throughout the area of concern in order to increase the utilization capacities of the processing centers.

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GLOSSARY

Land Use Classes

Forest land -- Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for non-forest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is one acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet in width.) Also see definitions for land area, commercial forest land, stocking, unproductive forest land, and water. -- U.S.F.S.

Commercial forest land -- The current USFS definition is -- forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capacity of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

The current CSFS definition is -- forest land that is not capable of yielding usable wood products (usually sawtimber) due to adverse site conditions including physical inaccessibility, or land that does not meet the criteria of: (1) Either 1,500 board feet or 600 cubic feet per acre, and (2) 40 square feet of basal area per acre of trees 5 inches dbh or larger.

Marginal component -- A component of forest land suitable for regulated timber production but not currently available because of constraints from associated

resource needs, high development costs and low product values, or absence of market for the species or product available. -- U.S.F.S.

Special component -- That part of the regulated forest land suitable and available for timber production which is recognized in the Multiple Use Plan as needing specially designed silvicultural treatment of the timber resource to achieve landscape or other key resource objectives. -- U.S.F.S.

Standard component -- The component of the regulated forest land suitable and available for timber production on which crops of industrial wood can be grown and harvested with adequate protection of the forest resources under the usual provisions of the timber sale contract. -- U.S.F.S.

Deferred forest land -- National Forest lands that meet productivity standards for commercial forest, but are under study for possible inclusion in the Wilderness System.

Unregulated forest land -- Portions of commercial forest land and the noncommercial forest land which will not be utilized for sustained timber production. -- U.S.F.S.

Noncommercial forest land --(1) Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and (2) productive-reserved forest land. -- U.S.F.S.

Productive-reserved forest land -- Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas tree production.

Inaccessible -- An area of forest land suitable for timber production but not available because the cost of building access roads is expected to exceed the monetary value of the first timber harvest.

Unproductive forest land -- Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions, because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.) -- U.S.F.S.

Nonforest land -- Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, power-line clearings of any width, and 1-to-40 acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved raods and nonforest strips must be more than 120 feet wide, and clearing, etc., more than 1 acre in size, to qualify as nonforest land.) -- U.S.F.S.

Ownership Classes

Ownership -- Property owned by one owner, regardless of the number of parcels in a specified area.

National Forest land -- Federal lands which have been legally designated as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Bureau of Land Management lands -- Federal land administered by the Bureau of Land Management.

Indian lands -- Tribal lands held in fee by the Federal Government, but administered for Indian tribal groups and Indian trust allotments.

Miscellaneous Federal lands -- Federal lands other than National Forest lands, lands adminsistered by the Bureau of Land Management, and Indian lands.

Other Federal lands -- Federal lands other than National Forest lands, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal agencies.

State, County, and municipal lands -- Lands owned by states, counties, and local public agencies or muncipalities, or lands leased to these governmental units for 50 years or more.

Other public -- All federal lands other than National Forest lands, and State, county, and municipal lands.

Farmer-owned lands -- Lands owned by farm operators. (Note: These exclude land leased by farm operators from nonfarm owners, such as railraod companies and states.)

Forest industry lands -- Lands owned by companies or individuals operating wood-using plants.

Forest Type and Tree Species

Forest types -- A classification of forest land based upon the species forming a plurality of live-tree stocking. (Note: Types shall be determined on the basis of species plurality of all live trees that contribute to stocking; that is, up to a maximum of 16 percent at each plot point based upon a 10-point location.) -- U.S.F.S.

Major forest type -- A grouping of local forest types into about 10 eastern and 10 western groups. The groupings are based upon similar and associated species.

Commercial species -- Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality, such as hawthorn and sumac, scrub willow and alder.) -- U.S.F.S.

Noncommercial species -- Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Softwoods -- Coniferous trees, usually evergreen having needles or scalelike leaves.

Hardwoods -- Dicotyledonous trees, usually broad-leaved and deciduous.

Classes of Timber

Growing-stock trees -- Live trees of commercial species meeting specified standards of quality or vigor; excludes cull trees.

Rough trees -- (1) Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs each 8 feet long or longer -- now or prospectively -- and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form; (2) all live trees of noncommercial species. -- U.S.F.S.

Rotten trees -- Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer -- now or prospectively -- and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten. -- U.S.F.S.

Cull -- Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect. Five year mortality - number or sound-wood volume or live trees dying from natural causes during a 5 year period.

Salvable dead trees -- Standing or down dead trees that are considered merchantable by Regional standards.

Mortality trees -- Trees formerly growing stock dying from natural causes during a specified period, usually annually.

Sound dead -- Standing or down dead trees that have 50 percent of the cubic foot volume sound.

Diameters and Size Classes

Diameter classes -- A classification of trees based on diameter outside bark, measured at breast height (4 1/2 feet above the ground). (Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive.)

Tree size class -- A classification of trees based on daimeter at breast height, including sawtimber trees, poletimber trees, and saplings and seedlings.

Seedlings -- Live trees less than 1.0 inch in d.b.h. -- U.S.F.S.

Saplings -- Trees 1.0 to 5.0 inches in d.b.h. -- U.S.F.S.

Poletimber trees -- Trees at least 5.0 inches in d.b.h., but smaller than sawtimber size. -- U.S.F.S.

Sawtimber trees -- Trees exceeding poletimber size. The U.S.F.S. defines sawtimber in the Intermountain States as the minimum dbh for softwood is 9.0 inches and 11.0 inches for hardwoods. The C.S.F.S. defines sawtimber as 11.0 inches dbh or greater and poletimber between 5.0 and 10.9 inches dbh.

Net volume -- Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Growing-stock volume -- Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0 inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

International 1/4-inch rule--The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Growth and Mortality

Gross growth--Annual increase in net volume of trees in the absence of cutting and mortality. Includes ingrowth and accretion.

Net annual growth -- The increase in net volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became rough or rotten trees during the year.)

Ingrowth -- The number or net volume of trees that grow large enough during a specified year to qualify as saplings, poletimber, or sawtimber. The measurement is at the size of entry into the size class.

Accretion -- Annual increase in net volume of trees in a size class, and the increase in net volume of trees after reaching a measured size class during the year.

Mortality -- Number or sound-wood volume of growing stock trees dying from natural causes during a specified period.

Timber Cut

Allowable cut -- The volume of timber that could be cut on commercial forest land during a given period under specified management plans aimed at sustained production of timber products. This U.S.F.S. term is synonymous with potential yield as used in this report.

Timber removals -- The net volume of growing stock trees removed from the inventory by harvesting, cultural operations, such as timber-stand improvement, land clearing, or changes in land use.

Timber products -- Roundwood products and plant byproducts. (Note: Timber products output includes roundwood products cut from growing stock on commercial forest land, and from other sources, such as cull tree, salvable dead trees, limbs, and saplings, or from trees on noncommercial and nonforest lands, and from plant byproducts.)

Roundwood products -- Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: includes saw logs, veneer logs and bolts, cooperage logs and bolts, pulpwood, fuelwood, piling, poles, hewn ties, mine timbers, and various other round, split, or hewn products.)

Plant residues -- Wood materials from manufacturing plants not utilized for some product. (Note: Includes slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings.)

Logging residues -- The unused portions of trees cut or killed by logging.

Other removals -- The net volume of growing-stock trees removed from the inventory by cultural operations, such as timber-stand improvements, land clearing, and changes in land use.

Rotation -- The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

Quality

Industrial wood -- All roundwood products, except fuelwood.

Site

Site class -- A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Site classifications are based upon the mean annual growth of growing stock (not including thinnings) attainable in fully stocked stands at culmination of mean annual growth. Height-age relationships are usually used as indicators of the specified volume-site class.

Stand Size Classes

Stand-size class -- A classification of forest land based on the size class of growing stock trees on the area, that is, sawtimber, poletimber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point, based upon a 10-point location, will be considered in determining stand-size class.)

Sawtimber stands -- Stands at least 16.7 percent stocked with growing stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands -- Stands at least 16.7 percent stocked with growing stock trees in which half or more of this stocking is a poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands -- Stands at least 16.7 percent stocked with growing stock trees in which more than half of the stocking is saplings and/or seedlings.

Nonstocked land -- Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Definitions of Other Terms as Used in This Study

Accessibility adjustment factor -- A percentage applied to an inventory figure to estimate the acres or volume of a given class of raw material that is available to a processing center. This percentage is arrived at by totaling the acres of standard, special, and if available, the unregulated components of the national forest land in question. Most often these areas would not require unprogrammed forest road and trail expenditures. The above total is then divided by the total number of acres of forest land inventoried in the area. The accessibility factor is used on federal lands only. State and private lands are assumed to be 100% accessible.

Area adjustment factor -- A percentage applied to an inventory figure to measure the acres and the volume of timber in a particular land ownership that is bisected by a tributary area boundary. The volume of timber is calculated proportional to the land included inside the tributary area boundary.

Area of concern -- All mountain pine beetle infested and threatened forests, regardless of ownership, accessibility or economic operability of the timber. All lands between isolated infestations are included.

Processing area -- A processing area is an area where the products are potentially, or are, being manufactured. An example is the Fort Collins-Loveland processing center. It is an area composed of two cities.

Processing center -- This is an inclusive term which means either a processing site or a processing area.

Processing site -- A processing site is an equivalent of a processing area except only one city or town is considered. Denver is an example of a processing site.

Tributary area -- This is the geographic area from which a processing center can potentially draw its raw wood material. The boundaries of thes area are not absolute. They are subject to change because of changing economic factors.

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